# Intellectual Teamwork

## Social and Technological Foundations of Cooperative Work

Edited by

Jolene Galegher
*University of Arizona*

Robert E. Kraut
Carmen Egido
*Bell Communications Research*

LEA
1990 LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
Hillsdale, New Jersey Hove and London

# 12

# Voice Messaging, Coordination, and Communication

Ronald E. Rice
*Rutgers University*

Douglas E. Shook
*University of Southern California*

**Abstract**

What are the conditions under which users will take advantage of sophisticated communication systems to enhance their coordination and collaboration? Voice mail systems include both simple answering machine functions and more sophisticated, communication-oriented features such as sending messages directly or with a time delay to other users, forwarding messages, diverting on-going calls for later retrieval, and broadcasting messages to a distribution list. This chapter examines voice mail use in several divisions of a nationwide insurance company. Users report that voice mail was useful for time-delayed communication and for retaining affect in delayed communication. Workers used sophisticated communication features most in complex, nonroutine jobs. In more complex jobs, the communication behavior of peers strongly influenced the degree to which workers used voice mail, while in less complex, more routine jobs, the communication behavior of one's supervisor predicted the use of voice mail.

Day after day the corporate claims division of the nationwide insurance company studied in this chapter must provide quick service, interpret ambiguous information, overcome obstacles such as telephone tag and scheduling meetings, as well as coordinate communication among members of work units and between divisional boundaries and with large client organizations. This particular division handles inquiries and claims dealing with policies in commercial areas (theft, fire, commercial auto, etc.). Internal and external auditors assign claims according to the claimants' various policies.

The primary customers are the independent agents; however, some policyholders also call if a claim is pending. Telephone traffic is very heavy. The claims office uses two call sequencers, with four administrative assistants answering the calls in order after the sequencer releases the call (if the caller has not hung up by then; the average time on hold is 5.75 minutes). The assistants then relay messages to six outside adjusters. Supervisors also leave assignments for the adjusters through the assistants. The adjusters are required to call in twice a day for messages. When they do establish contact, which is not easy because often the lines are tied up by other adjusters calling in, they leave their phone number for customers to call with questions. However, adjusters generally have to gather information about a claim before they can answer. This preparation often requires in-depth research, involving a series of communications among supervisors, adjusters, and file processors, often to resolve questions and problems for which there are no clear policy answers. A supervisor may delegate a portion of this problem to one or more subordinates, and occasionally has to meet with the group working on the problem—perhaps even calling in the adjuster—to resolve particularly unclear issues.

As this example illustrates, many tasks facing large organizations demand a variety of individual talents and skills, involve multiple sequences of actions and decisions, and involve multiple departments or external organizations. Additionally, during basic research, new product development, initiation of new projects or approaches, and so forth, it is common for personnel to be organized around projects, or to work together on various portions of organizational tasks (Burgelman & Sayles, 1986; Katz & Tushman, 1979; Keller, 1986). Thus the abilities to exchange the right information, to communicate rapidly and effectively among several interdependent people, and to foster shared interpretations of ambiguous situations, are critical for effective group and organizational performance (Goodman & Abel, 1987). Thus much information work requires coordination and collaboration.

Computer-mediated communication systems, especially text-based systems such as electronic mail and computer conferencing, have gained a foothold in American organizations and have provided considerable opportunities for research (Hiltz & Turoff, 1978; Kiesler, Siegel, & McGuire, 1984; Rice, 1980, 1987; Rice & Associates, 1984). More complex, but less accessible, systems include group decision support systems, electronic blackboards, intelligent information retrieval systems, groupware systems, and other systems described in this book.

In this chapter, we consider how voice mail systems can facilitate coordination and collaboration of organizational work. We describe what voice mail is, its market, and its applications. We particularly distinguish between the use of voice mail for answering or messaging. Use of voice mail for its messaging capabilities, we argue, is not only best understood in the context



of shared tasks and managerial coordination, but also is likely to foster greater communication benefits than its use only for voice answering. We therefore develop a theoretical model for assessing the influence of these contexts on the use of voice mail, and for predicting some of the potential communication outcomes of voice mail. We provide both qualitative and quantitative evidence of these relationships based on a longitudinal study in a multisite insurance organization, and discuss the implications of these results.

## VOICE MAIL: DESCRIPTION, MARKET, AND APPLICATIONS

Many of the systems designed to support collaborative work are still in the prototype stage, or are still too expensive for wide diffusion. Many media are currently available, however, for maintaining interactive, location- or time-independent communications: cellular car phones, personalized answering services, voice mail, answering machines, beepers, and electronic mail. Related accessible applications include linking cellular telephones to voice mail, combining databases with voice mail via audiotex, and paging clients on the basis of voicemail calls (Ruprecht & Wagoner, 1986).

Voice mail (VM) is a computer-aided telephone system capable of storing and forwarding digitized spoken messages. VM systems combine computer storage and processing with the conventional abilities of a private branch exchange (PBC), a Centrex switch, or even a personal computer with an add-on board and large harddisk storage. Each user has a voice mailbox and an ID number. Users may record and send messages directly and asynchronously to another user's mailbox. Users may also store incoming messages for reference, forward messages to other users, record and store a message for future delivery, broadcast a single message to a number of users, trigger a "rollover" function that diverts conventional incoming calls from one's telephone extension into the voice mailbox, change the greeting message, control the volume and speed of messages, or use an on-line directory of names to find another user's voice mailbox. Due to its natural and accessible interface—the nearly ubiquitous touch-tone telephone—VM could have a wider appeal than text-based computer-mediated communication systems—which require users to have access to, and type on, computer terminals—for many applications.

VMX, Inc. installed the first major commercial VM system at 3M Corporation in May 1980. Approximately 500 systems were sold to U.S. businesses in 1984 (Henricks, 1985). By early 1985, 9 of the top 30 Fortune 500 companies used voice message systems (Matthews, 1985). At Eastman Kodak alone there are more than 16,000 users (Paznik, 1987). VM market

revenues grew from approximately $30–50 million in 1983, to $300 million in 1985, and are expected to grow to $500 million in 1988 and $1 billion in 1990 (Chevreau, 1986; Crawford, 1986; Goldstein, 1986; Hafner, 1986; Kondo, 1985; Pollack, 1985). The market is particularly likely to pick up in the next few years because a Computer III inquiry ruling allows the local telephone operating companies to offer VM services (Moore, 1986).

VM systems offer a wide range of possible benefits and applications due to the reduction of constraints on traditional telephone communication—as well as other communication, such as staff meetings or memos (Beswick & Reinsch, 1987; Parker, 1987; Rice, 1987; Stewart, 1985). For example, consider the problem of telephone tag: only one in five land-to-mobile calls is typically connected on the first attempt; only one in four business calls is successfully completed on the first attempt (Fennel, 1986; Pfeiffer, 1986); three-quarters of telephone calls require only a one-way drop of information, whereas half of all calls contain content not related to the explicit purpose of the call (Town, 1983). Reinsch and Beswick (1988) found, based on telephone diaries kept by 350 employees for a week-long period prior to implementation of voice mail, that the respondents, on the first try, did not successfully complete 38% of their internal phone calls or 25% of external calls, and 32% of all their calls were repeat attempts or return calls.

While potentially reducing many of the problems associated with conventional telephone communication, VM, however, introduces some constraints of its own, such as technical incompatibility across systems, unanswered messages, inability to produce a written record, insufficient computer memory to store long messages or messages for long periods of time, security, incomplete adoption by a user population, and so forth.

This study analyzes how VM may support coordination and collaboration in organizational work. Central to our argument is the conceptual distinction between two categories of VM use:

*Voice answering* is the interception, receipt, and storage of messages until the receiver is prepared to hear them. In a VM system, this function occurs when an outside client calls intending to reach and talk to an organizational representative who is away from the telephone or busy. The VM system simply records the message, much like an answering machine. The intended receiver listens to the recording when convenient, and responds as appropriate, often by another telephone call or a memo. Telephone answering is particularly appropriate for organizational tasks characterized by (a) large or bursty call volumes, (b) fairly predictable messages, (c) the need to allocate some time for uninterrupted work to prepare for a return call, and (d) the need to capture relatively routine information without providing feedback. In the example that started this chapter, voice answering could resolve some of the problems such as leaving messages requesting information, assigning claims cases, and checking for clients' calls.



*Voice messaging* is the intentional use of the system for asynchronous communication, employing capabilities for processing the communication such as forwarding, distribution lists, prioritizing, speed browsing of messages, and so forth. Voice messaging is particularly appropriate for organizational tasks characterized by (a) exchanging information among a group of employees, (b) the involvement of persons who are hard to reach because they are mobile or work in different time zones or shifts, (c) broadcasting small amounts of information to many people, (d) requiring only asynchronous information exchange, perhaps in response only to another message, or (e) the need to store messages as reference material or for future delivery. Generally, voice messaging facilitates the coordination and management of complex or collaborative communication activities among a number of users. In the example, voice messaging could resolve some of the problems such as maintaining the customer's original explanation of the problem along with the supervisor's delegation of the task to several subordinates by distributing both in one message, or by a sequence of interactions among several employees that resolve an ambiguous policy decision but avoids having to schedule and wait for a meeting.

## THEORETICAL FRAMEWORK FOR IDENTIFYING INFLUENCES AND OUTCOMES OF VOICE MAIL USE

Although it would be simple to provide examples of VM uses for voice answering and voice messaging, we feel that it is more insightful to develop a theoretical framework that predicts the influences on VM use and on communication outcomes. Hypothesized relations supported by our empirical study may then be applied to other situations where computer-mediated communication systems may support coordination and collaboration.

### Organizational Structure and Task Environments

The general theoretical foundation of the present research is contingency theory (Burns & Stalker, 1961; Galbraith, 1973; Lawrence & Lorsch, 1967; Perrow, 1972; Thompson, 1967; Woodward, 1956). Gutek's introductory chapter provides a rich and detailed review and critique of this theoretical approach, so we mention only those aspects most relevant to our analyses of VM use and outcomes. Contingency theory argues that organizational structure is, to a large degree, an artifact of the interaction of an organization's legal incorporation, markets, constraints, problems, technology, and environments. Environments create tasks that require the organization to process different amounts and kinds of information. Effective organizational

performance depends on a good fit between the organization's structure, its processing and communication capabilities, and these task requirements.

An organization adapts its structure to environmental requirements by creating horizontally and vertically differentiated units.

*Horizontal differentiation* creates work units particularly well-suited for, or specialized in handling, a given set of tasks. To successfully meet task demands, individuals must communicate in concert with others performing similar or interdependent tasks that have similar information-processing requirements; appropriate structures bring these individuals together. Thus communication activities of others in an individual's work unit should in some way influence the individual's communication activities. Furthermore, before a communication medium or system can support the coordination of, or the interaction among, interdependent organizational workers, there must be a "critical mass" of users, that number of adopters that both increases the value of the system and reduces the costs of learning how to use the system sufficiently to motivate enough others to use the system so that all may perform their tasks (Markus, 1987; Rice, Grant, Schmitz, & Torobin, in press).

*Vertical differentiation* creates structures (i.e., the organizational hierarchy) that coordinate the various horizontally differentiated units, with supervisory-subordinate relations based on authority and responsibility as the basis for information flows both up and down the organization (Fayol, 1949). Insofar as superiors attempt to coordinate the work unit members through their communication activities, and insofar as subordinates have less discretion in choosing to respond or not, a superior's communication activities should directly influence the subordinate's communication activities.

Organizational task environments have been categorized into two primary dimensions: the relative number of exceptions to routine procedures one encounters during the performance of daily responsibilities, and, given these exceptions, the analyzability of the search for information necessary to cope with the exceptions (Perrow, 1972). As the number of exceptions increases, and as the analyzability of these exceptions decreases, the organization must increase its coordination of information and communication flows in order to perform well. Increased coordination of workflows may involve increased amounts of communication, but, more importantly for the present research, may require changes in the type and direction of communication.

In modern organizations, computer-based information systems are new ways to support this differentiation and coordination (Huber, 1984). With respect to VM, the distinction between increased amount and changed type of communication corresponds to the difference between voice answering and messaging.



## Media Characteristics and Communication Tasks

The derived, and more specific, theoretical foundation of this study is the hypothesized relationship between media characteristics and task demands, known under the conceptual labels of social presence and information richness.

Until recently, the possibilities for communication channels have been categorized into (a) face-to-face or (b) mediated (typically meaning broadcast mass media such as radio, television, newspapers, and other print media). Although there has been some social science research on the use and impacts of the telephone (Pool, 1977; Short, Williams, & Christie, 1976), generally the telephone has not received much attention even though (and perhaps because) it lies on the boundary of these two categories.

Each communication channel within these two traditional categories operates under a broad range of constraints, such as the number and type of senses involved (vision, hearing, touch, etc.), whether users must use the medium simultaneously, be in the same place, need to know the exact address of a recipient, must use a sequence of different media, can send the same message to multiple people at the same time, can process the message (such as storing, forwarding, editing, retrieving), can access the medium from a variety of places, can obtain or provide rapid feedback, and so forth (Rice, 1987). With the convergence of computers and telecommunications, new media have reduced or created different patterns of constraints. The conventional telephone, for example, has an intermediate level of constraints, whereas computer-based VM has fewer constraints—in some ways fewer than face-to-face communication. So although VM is not face-to-face communication, it may have more potential for supporting coordination of organizational work than channels traditionally categorized as "mass media."

In spite of the potential reductions in communication constraints that new media may provide, some media theories tell us that the influence of any medium partially depends on how well the characteristics and constraints of the medium (such as VM) fit the task's information-processing and communication requirements (such as coordination). This fit is related to the extent to which a medium can convey *social presence* (Short, Williams, & Christie, 1976) or *information richness* (Daft & Lengel, 1986).

Social presence is the degree to which a communication medium conveys the actual physical presence of the participants communicating. Social presence is a perceived attribute of a medium that is dependent on the context of the communication as well as on the intrinsic characteristics of the medium. It is most frequently measured either by a set of semantic differentials (such as warm and cold, personal and impersonal, precise and ambiguous), or more explicitly, by statements about the appropriateness of

different media for a range of common organizational communication tasks (such as exchanging information, resolving disagreements, or getting to know someone).

Daft and Lengel (1986) proposed that communication channels differ in the extent to which they are rich in information, that is, are able to bridge different frames of reference, make issues less ambiguous, or provide opportunities for learning in a given time interval, thus influencing task and organizational performance. They extend the question of task-medium fit to organizational hierarchies, arguing that because higher-level managers spend more time making strategic decisions and reducing equivocality from environmental inputs, they must use more information-rich media in order to perform well. Trevino, Lengel, and Daft (1987), for example, found that a small sample of managers reported that they would be more likely to use rich media such as face-to-face communication for low analyzable tasks, meetings and written memos for symbolic purposes (such as indicating an official communication), and information poor media such as electronic mail for overcoming situational constraints.

Channels high in social presence or information richness, such as face-to-face communication or video conferencing, can convey motion, distance, and paralinguistic cues, as well as denotative content. Channels such as a business memo or a computer printout are categorized as low in social presence or information richness. The telephone and electronic mail typically have been categorized as being somewhere in the middle of these continua (Rice & Love, 1987; Rice & Shook, 1990; Short et al, 1976, p. 71).[1] VM, because it provides both the cues of spoken communication with the processing and transmission capabilities of computer systems, may well provide both considerable information richness/social presence and the ability to overcome situational constraints. Thus, it may be quite appropriate for supporting coordination and collaboration, tasks that require sequences of interactions and may not be easily analyzed.

## HYPOTHESES ABOUT RELATIONSHIPS AMONG VM USAGE, MEDIA CHARACTERISTICS, STRUCTURAL EFFECTS, AND TASK ENVIRONMENT

We attempt to assess the validity and utility of the theoretical model developed elsewhere by testing the following hypotheses:

[1]We should note that although the social presence literature has provided considerable empirical evidence, there has been little empirical testing in the information richness literature, despite considerable theoretical elaboration. One of the main contributions of the present research is to provide a rigorous test of some of the implications of information richness theory.



### VM and Media Characteristics

H1. VM can reduce situational constraints.

H2. VM can provide information rich communication.

### VM, Structural Effects, and Task Environment

H3. VM can better support the coordination of organizational tasks when there is a critical mass of other users.

H4a. A work unit's use of VM will positively influence individual work unit members' use of VM (horizontal differentiation effect).

H4b This relationship will be stronger in less analyzable task environments.

H5a. A supervisor's VM usage will positively influence subordinates' usage (vertical differentiation effect).

H5b. This relationship will be stronger in less analyzable task environments.

### VM, Outcomes and Task Environment

H6a. The use of VM will lead to an improved ability to distribute and to obtain information.

H6b. This relationship will be stronger in less analyzable task environments.

H6c. This relationship will be stronger when individuals use VM more for messaging than for answering.

H7. These relationships will occur when controlling for effects of innovativeness, hierarchical level, and organizational tenure (see Shook, 1988 for a full discussion of these influences; our purpose here is simply to control for these as alternative explanations).

Figure 12.1 portrays the relationships implied by hypotheses H4–H7.

## SAMPLE AND SITE

A large insurance organization in the process of pilot testing a voice mail system provided the setting for the study. The sample included approximately 550 organizational members in sites at three cities who were tar-

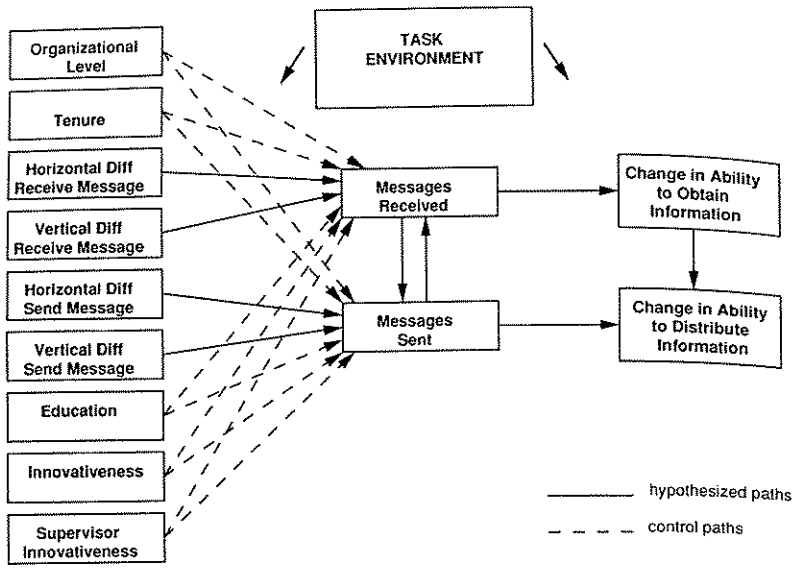


FIG. 12.1. Theoretical Model of Voice Messaging Use, Differentiation, and Communication Performance. Higher Use of Messaging, and Greater Improvements in Dependent Variables, are Predicted for Less Analyzable Task Environments. Greater Improvements in Dependent Variables are Predicted for Those Who Use the System More for Messaging Than for Answering.

geted as potential users of the VM system and thus would receive voice mailboxes (accounts). Respondents included organizational members from all hierarchical levels and a wide variety of areas of expertise (e.g., sales, management, clerical, technical, legal services, administrators, etc.).

The initial rationale for this pilot VM implementation was to solve communication problems experienced by field agents who had difficulty contacting headquarters personnel who were often away from their desk. Twenty locations in the Northeast (out of the approximately 300 field office locations nationwide and the home office) were initially selected that involved some of the 10 applications previously identified as having communication needs appropriate for VM. Final sites and applications were selected on the basis of which applications they performed and their willingness to become involved in the pilot. They included: Claims processing, marketing, and employee benefits in one field office; marketing, two classes of claims processing, and administration in another field office; and corporate audit, litigation, telecommunications, and corporate technology planning in the home office.

The VM systems were not networked across the three cities, but all of the organization's buildings within a city location had access to the same system. Only a small portion of our respondents had access to an IBM PROFS system for electronic mail, but use was minimal. A dedicated telephone toll line existed between two of the locations, but inspection of the monthly telephone records kept on microfiche showed that the number of calls was negligible.



## DATA COLLECTION AND MEASURES

Data collection included self-report questionnaires administered 1 month before (T1) and 5 months after (T2) implementation of the VM system, computer-monitored VM usage data collected weekly (see Rice & Borgman, 1983), archival information such as organizational charts, five focus groups consisting of five managers each (conducted during the end of the second data-collection period), and responses to open-ended questions on the questionnaires. The number of cases from the questionnaire data for each variable ranged from 227 to 326, except for two change-in-performance variables, with $N = 120$ cases in common between T1 and T2.

Questionnaire measures included (a) a standardized four-item scale measuring task analyzability (Withey, Daft, & Cooper, 1983), divided into high and low analyzable task environments by dichotomizing the scale at the mean; (b) change in two performance variables—ability to get information, and ability to distribute information—computed by subtracting responses at time 2 from responses at time 1; (c) a standardized 10-item individual innovativeness scale (Hurt, Joseph, & Cook, 1977); (d) simple ordinal measures used as indicators of organizational level according to a ranking provided by our organizational contact; (e) education; (f) tenure; (g) self-report measures of the number of messages sent and received per day; and (h) the percentage use of the system as an answering machine compared to usage of the system for voice messaging. Table 12.1 provides statistical descriptions and sample items for these measures.

Computer-monitored VM usage measures (based on 6,400 data points) were divided by the number of weeks (mean 12.5, minimum 2, maximum 21) since the respondent first used the system, and then normalized to enable use of parametric statistics. The quantitative analyses use only those respondents who had nonzero computer-monitored usage data.

To represent the influence of vertical differentiation in VM usage, we created two new variables for each subordinate that were equal to the number of (normalized) VM messages sent and received by the subordinate's superior.

We identified respondents as horizontally undifferentiated (members of a work unit) if they reported to the same superior. For the variables representing the influence of horizontal differentiation in VM usage, the means of

TABLE 12.1
Descriptive Statistics and Sample Items of Variables

| *Variable* | *M* | *S.D.* | *Cronbach's Alpha Reliability* |
|---|---|---|---|
| Size of work units | 4.7 | 3.1 | |
| Mean task analyzability | 2.9 | .9 | .79 |
| sample items: "clear known ways to do work" "rely on established practices" from 1 (very little extent) to 5 (very great extent) | | | |
| Change in "able to get the information I need from others on time" from 1 (strongly agree) to 7 (strongly disagree) | .4 | 1.6 | |
| Change in "can distribute information to groups of people quickly and easily" from 1 (strongly agree) to 7 (strongly disagree) | .1 | 1.9 | |
| Innovativeness | 5.6 | .8 | .81 |
| sample items: "skeptical of new ideas" "challenged by ambiguities" from 1 (strongly agree) to 7 (strongly disagree) | | | |
| Organization level from 1 (management) to 7 (secretarial/clerical) | 3.7 | 2.0 | |
| Education from 1 (high school) to 5 (graduate school) | 3.1 | 1.2 | |
| Tenure years at the organization | 10.6 | 8.5 | |
| Percent use of VM for messaging | 28% | 33% | |
| Mean messages sent per day: | | | |
| 484 voicemail box holders | 1.1 | 3.2 | |
| 290 who ever used VM* | 1.8 | 4.0 | |
| Mean messages received per day: | | | |
| 484 voicemail box holders | 1.2 | 2.0 | |
| 290 who ever used VM* | 1.5 | 3.2 | |
| Self-reported voice messages sent and received per day | 6.6 | 5.5 | |

*Although the mean computer-monitored usage appears low, even when just considering users, usage patterns are highly skewed: 190 of the 484 voice mailbox account holders never sent a message even though they may have received messages, and the maximum number of



the two (normalized) VM variables for all subordinate members of a work unit were computed, then multiplied by the number of persons in the work unit. For each individual, the value of that individual's VM usage measure (messages sent and messages received) was subtracted from this product, and this difference was divided by $n - 1$. The resulting value measures average (normalized) VM usage within a user's horizontally differentiated work unit.

## QUALITATIVE RESULTS

### Overcoming Constraints

VM can overcome situational constraints inherent in using the telephone, which not only requires both communicators to use the medium at the same time, but also generally involves the transformation of the communication content across several media (such as writing a message slip, copying that to a calendar, mentioning the information to another person, writing the information onto a memo, calling back to confirm, etc.) (Rice & Bair, 1984). For example, the average call holding time in the example that began this chapter dropped from nearly 6 minutes to less than 1 minute after VM was implemented.

In response to the open-ended questionnaire item, "For what specific applications or opportunities could voice messaging be especially useful?", the two most common categories of responses were "During travel, lunch, breaks, after hours" ($N = 39$, 18.9%) and "Avoid telephone tag" ($N = 11$, 5.3%). Focus group comments provided other evidence of the ability of VM to overcome some communication constraints:

> "Well, before it was a real pain because you had to sit there and write, listen to the phone conversation and make your notes while you were doing that, then make your instruction notes and then sent them on. So we had to write all that stuff down."

messages sent per day was nearly 40. Furthermore, they are very similar to usage figures reported from other systems: (a) in an integrated voice and text system, 86 users who had been on the system for a year sent .4 voice messages/person/day (Nicholson, 1985); (b) 350 users who had been on a voice mail system for three months sent 1.3 messages/person/day (Reinsch & Beswick, 1988); and (c) in three companies reported by Paznik (1987), the number of messages sent per person per day (although based upon monthly figures) was approximately 1.4, and the number of messages received was 2.7.

"You bet. Hang on a minute. Pete, pick up on line one. If Pete's not there and I know that the case is going to go to him, I can record the message [with voice mail]. Hang on a minute, let me get the recorder on. I can record the message and then I can leave the recorded message to Pete's line."

"I like the group distribution system where my immediate staff's on it . . . instead of before, I had to dictate out an action slip to my secretary, she would have to type it out, she would have to get copies and then physically hand deliver these things."

With VM, one can avoid maintaining, indexing, and retrieving written messages, while using the timing function to place that information in a more meaningful context:

"Dick does a good job on his thing, just a quick four line message. I'd rather get it over the voice, through the phone, than have to read another daily memo and wade through ten piles of stuff to get to the memo that really means something to you . . . Yea, you just throw it on the floor and stuff it in your briefcase, and then you get home and you say, oh four hours ago."

"One of the biggest problems I have is handwritten notes all over the office and some aren't even on the desk, they get on the floor, in the file cabinets, filed away with someplace else, and you have no idea what you've been doing for the day. Being able to leave a message triggers what you called about and I really like that because at my age senility has set in."

Once the communication can be captured by voice mail, it then can be processed according to individual and organizational needs: "That concept of capturing information, you know, in voice, and then being able to move it around, is something that we've found to be really [valuable]."

## Information Richness

A major concern in a service-oriented industry such as insurance is the need to maintain personal contact with customers. Therefore, the use of VM raises the question of whether the medium is sufficiently information-rich, say compared to face-to-face or even to the regular telephone with its real-time communication. Indeed, in response to the open-ended questionnaire item, "How might voice mail affect the company's relationship with customer or agents?", two relevant categories of response were "May create 'customer only a number' atmosphere" ($N = 39$, 19.2%), and "Impersonal, but efficient" ($N = 9$, 4.3%). However the second and third most frequent categories of response were "Customer relations improved; better contact" ($N = 15$, 7.2%) and general positive impacts ($N = 10$, 4.8%). With respect to internal use of VM, a typical initial response pointed out that communication is less rich if it is mediated, but that initial opinion can change: "In some cases, I physically see the person calling my mailbox, leaving a message, or I'm sitting in my office and, at first I would try to figure out the reasons why they don't like talking to me. But, after getting used to that, I found that it was a very effective means of communication."



VM can provide the information richness of audio communication as well as overcome constraints inherent in both face-to-face communication and other mediated communication such as written notes:

"So my responsibility right now is take the message, call Pat, or call whomever the contract is assigned to and say, okay, here's what they wanted, get back to them. Now the sense of urgency is gone because it's now a written message. It's no longer a telephone message. The sense of urgency has suddenly been degraded and they say, well I've got these other four things to do and all of a sudden, that answer may come out two or three days later. Because they didn't hear the guy, and as much as I may tell them, boy, he was pounding on his desk, I could hear him . . . But if I could do as John said, let me record this message . . . , and if I could at least record the message and I said, number one, listen to what this guy is saying, and not only Pat, but Mike or Vicky or whomever, and let them get the message."

". . . doing business is not just cold passing around of information, it's a sense of what's this person going to do, what's this person committed to? You know, what this person can buy, how's this person going to react to what we're doing here. That's how we do business."

## Communication, Coordination, and Critical Mass

VM can support the management and coordination of work, through delegation of tasks, broadcasting of information, and timely handling of communication. In response to the open-ended questionnaire item, "What did you like best about using voice mail?", the most frequent category of response was "More information; better prepared for return call" ($N = 20$, 9%). Other relevant response categories were "Having 24-hour access" ($N = 11$, 5%), and "Higher rate of answered calls" ($N = 8$, 3.6%). Focus group participants elaborated:

"The ability to move messages is what's important. Especially me when I'm trying to run an organization from out of town.

Messages, yea. And what happens with the new work is that I can assign the new work from wherever I am by simply taking that telephone call that comes into me where somebody says I have a problem with my message, my set of instructions, and assign it to whomever is best qualified to handle the case without ever having to write anything down. And getting it done in a hurry."

"I think that transmittal of phone calls that come in, taking that message and being able to send it to another person and saying, here, this is for you, you should be handling this. This delegation thing that John was talking about. Saying, okay, this guy called about this [its] your area to handle, you handle it, then it's done, it's almost done now—you don't have to write it."

"And, quite frankly, some very successful implementations of voice messaging systems . . . are . . . not used in a telephone answering mode at all, but rather they're used to communicate information more quickly."

Respondents were quite explicit about the need for a critical mass of users to make the voice mail system more valuable, especially the messaging capabilities:

"If all the departments were on voice messaging and everybody was familiar with it and we had fluent use of it all the time, I could see easily that it should be able to cut down our acceptance of information and data and also our sending out the questions and information that we need in order to respond."

"Almost overnight, you get on the phone, you've got the group distribution list and all of your key contacts and your key departments and they know about them immediately and at least can start thinking about it even before they get some documentation in the mail."

"Rick, you pointed out that some of the key people you need to interact with aren't on the system, so therefore, you wind up using it as an answering service."

The increasing complexity of information work requires increased coordination, which VM can facilitate:

"Before proposal preparations got so complicated, you had to tap into the expertise of other departments, we used to do a lot more internally, but the business has gotten so complicated that we need to ask other people to help us out."

"Within our area, in development of proposals, insurance proposals, where a marketing strategy, there has to be constant communication both between the field office and within our unit. So, it's really in the exchange of information and communication, we use it as a true mailbox voice messaging service, not as an answering machine. And that's an important distinction."

"It's not the telephone tag of that external person trying to get hold of Rick or John, it's the telephone tag of your [representative] in Milwaukee trying to get hold of you or of your analyst down in the other department that doesn't know you're not at your desk cause you're in a meeting, needing to pass that information to help you get that account."



VM can be combined with other media to increase the ability to manage and coordinate work:

"It is not part of the session, but we've put cellular phones in each of their cars so that while they're traveling from one agent to another, they can ring up their mailbox, see how many messages they have. (Are you finding that they leave you messages like, this is what's happening in this agency, so you have a better sense of what's happening in their work, rather than just where they are?) Yea. No question about that."

## QUANTITATIVE RESULTS

### Overall Results

Shook (1988) provided detailed descriptions of items, scales, correlations, and tests of specific models. For the purposes of this chapter we simply describe the most relevant results of structural equations models based on the hypothesized model in Fig. 12.1, as tested by LISREL, a maximum-likelihood structural equation modeling program. We report results from the overall model, from separate models for high and low analyzable environments, and from separate models for high and low use of voice messaging (versus voice answering).

The overall model pictured in Fig. 12.1 had a nonsignificant chi-square statistic (28.85, $p = .26$), indicating that the associations proposed by the model were not significantly different from the observed associations. The adjusted goodness of fit index was .81, and the coefficient of determination was .87. The overall model explained from 60% to 79% of the variance in the two usage variables (sending and receiving voice messages), and nearly 40% of the variance in the two performance variables (change in distributing and obtaining information).

Horizontal differentiation was a strong and significant predictor of sending messages and a moderate predictor of receiving messages; number of messages sent by a respondent's work unit significantly predicted the numbers of messages sent by the respondent, and the same held for number of messages received.

Considering vertical differentiation effects, the influence of a superior's VM usage on the respondent's VM usage was significant, but reversed from the paths specified in the theoretical model presented in Fig. 12.1: number of messages sent by the superior predicted number of messages received by the subordinate, and number of messages received by the superior predicted number of messages sent by the subordinate. These results describe an organizational process of parallel communication within work units, but

sequential communication across vertical differentiation as determined by the superior's communication activities.

Ignoring the structural effects, the number of messages a respondent sent weakly but significantly predicted the number of messages the respondent received, but receiving messages had no significant effect on sending messages.

The number of messages received significantly predicted the change in ability to obtain information, and indirectly predicted the change in reported ability to distribute information, through the number of messages sent. An improved ability to obtain information predicted an improved ability to distribute information.

With respect to the hypothesized control variables, lower organizational level directly predicted improved ability to obtain information. Innovativeness directly and positively predicted improved ability to obtain information, and positively predicted number of messages received, but negatively predicted number of messages sent. Supervisor's innovativeness negatively predicted number of messages sent. Education and tenure did not independently predict either number of messages sent or received or the two performance variables.

## The Effect of Task Environment on the Relationships Between VM Usage and Performance

### *Different Usage in Different Task Environments*

Separate analyses were performed for those individuals in positions with high task analyzability and those individuals with low task analyzability. Simple t-tests between low and high analyzable environments showed that voice messaging was used more heavily in less analyzable environments (33% compared to 23%, $p<.01$, $N = 252$). The number of computer-monitored voice messages sent per day was not significantly different, though higher (1.40 versus 1.17), whereas the number of voice messages received per day was significantly greater in low analyzable task environments (1.54 compared to 1.09, $p<.05$). Thus, in low analyzable task environments, respondents used VM more, and used it more for messaging.

### *Influences on Usage in Low Analyzable Task Environments*

The average number of VM messages sent by one's workunit strongly predicted the number of messages sent by the respondent. The number of messages received by one's work unit also predicted the number of messages received by the respondent, but the relationship was less powerful. Higher education predicted the number of messages sent, and innovativeness predicted fewer number of messages received. Number of messages sent was a powerful predictor of number of messages received. Supervisor's usage (vertical differentiation effect) did not significantly affect a respondent's VM usage in this task environment. Approximately 70% of the variance in each VM use variable was explained by the model for low analyzable task environments.



### *Influences on Usage in High Analyzable Task Environments*

The number of messages sent by one's supervisor (vertical differentiation effect) strongly predicted the number of messages received by the respondent. The number of messages sent by one's work unit predicted the number of messages sent by the respondent. Innovativeness also predicted number of messages sent. 76% of the variance in number of messages received, and 36% in number of messages sent, was explained by the model for high analyzable task environments.

### *Improved Ability to Obtain and to Distribute Information in Different Task Environments*

Several models were used to examine differences between improved ability to obtain and distribute information in high and low analyzable task environments. As predicted, use of VM for messaging in high analyzable task environments did not predict changes in either ability. In line with our speculations about the fit of VM characteristics with task demands and potential benefits, using the system as an answering machine had no significant effect on changes in the ability to obtain or to distribute information. The use of VM for messaging, however, explained 23% of the improved ability to obtain information, and 26% of the improved ability to distribute information in low analyzable environments. Thus, when tasks require rich information or greater social presence because they are easily analyzable, the use of VM for messaging leads to improvements in the ability to get and distribute information. In more routine environments, the messaging capabilities of VM provide no additional benefits. Use of VM primarily for answering does not improve either of these communication activities.

## DISCUSSION

Table 12.2 summarizes the results for the tests of the hypotheses. The qualitative analyses of open-ended questionnaire items and focus comments provided specific comments to reinforce the commonsense percep-

TABLE 12.2
Summary Results of Hypotheses

| | |
|---|---|
| *VM and Media Characteristics*: | |
| H1. VM can reduce situational constraints. | Supported |
| H2. VM can provide information rich communication. | Supported |
| *VM, Structural Effects, and Task Environment*: | |
| H3. VM can better support the coordination of organizational tasks when there is a critical mass of other users. | Supported |
| H4a. A work unit's use of VM will positively influence individual work unit members' use of VM (horizontal differentiation effect). | Supported |
| H4b. This relationship will be stronger in less analyzable task environments. | Supported |
| H5a. A supervisor's VM usage will positively influence subordinates' usage (vertical differentiation effect). | Supported, but sequential effect |
| H5b. This relationship will be stronger in less analyzable task environments. | Not Supported; reversed |
| *VM,* Outcomes and Task Environment: | |
| H6a. The use of VM will lead to an improved ability to distribute and to obtain information. | Supported |
| H6b. This relationship will be stronger in less analyzable task environments. | Supported |
| H6c. This relationship will be stronger when individuals use VM more for messaging than for answering. | Supported |
| H7. These relationships will occur when controlling for effects of innovativeness, hierarchical level, and organizational tenure. | Supported; some effects of control variables |

tion that VM can overcome constraints inherent in both mediated and interpersonal organizational communication. These constraints are particularly critical when tasks require coordination in the form of sequenced and timely communication among several individuals. The comments also showed that although there is particular concern that general use of voice mail may be too impersonal with respect to external customers, it can be used to great advantage in serving external clients when applied wisely. Furthermore, with increased experience and awareness of the proper use of VM internally, concerns about impersonalness decrease. Much more in evidence was the awareness that the typical alternatives—written memos, phone messages, or having the problem handled by someone not completely informed—are less rich means of communicating. VM can be used to maintain personal cues even though the process is asynchronous. Finally, the comments provided clear indications of the ways in which VM, especially messaging, can support management and coordination of work, such as through delegation, broadcasting, monitoring, and increased



awareness of a project's progress. However, a critical mass of individuals involved in the coordinated task (such as processing a proposal) must have accounts on the VM system.

With respect to the quantitative analyses, the LISREL model for low analyzable environments best represents the theoretical model depicted in Fig. 12.1. Vertical differentiation (supervisor's VM usage) and horizontal differentiation (the average VM usage by one's work unit) strongly influences one's number of VM messages sent and received. Use of VM then directly predicts improved abilities both to obtain and to distribute information.

More general efforts to understand how and why individuals use different media in organizations may well be handicapped unless they consider both the task environment and influences of horizontal and vertical differentiation. Unless they take into account the extent to which tasks may require coordination and work unit communication, researchers may miss some of the contexts and consequences of intellectual technology. The power and parsimony of a structural approach, informed by theories of organizational contingency and media characteristics, is preferable to models dependent solely on an individual-level of analysis, and is theoretically appropriate for the study of coordination and collaboration of organizational work across different task environments. As a side note, using computer-monitored data provides highly reliable, and diverse, measures of communication system usage.

The number of VM messages sent influences the number of VM messages received, but not vice-versa, indicating that system usage generally is proactive. Users may often send messages to request information. This association could help explain the much stronger relationship between receiving messages and improved ability to obtain information, than between sending messages and improved ability to distribute information (primarily in low analyzable task environments). That is, obtaining information to conduct one's task or to coordinate tasks within a work unit is probably more important than distributing information. Regardless of task environment, use of VM for messaging rather than answering established a context for a significant positive relation between sending or receiving messages and improved communication.

Although horizontal differentiation is generally a strong predictor of the use of voice messaging, it is an even more powerful determinant in less analyzable environments, where VM is hypothesized to offer greater potential benefit because of its combination of greater social presence or information richness than written messages, and because it can overcome a variety of constraints to coordination and collaboration inherent in telephone or even face-to-face communication. However, system usage by the other members of an individual's horizontally differentiated work unit does not

universally determine that individual's use of VM. VM usage by the work unit had no direct effect on receiving messages in high analyzable task environments, where information richness theory indicates that richer media should have no special advantage for performance. For the work unit to influence media usage, tasks should require or potentially benefit from characteristics of the media—in this case, where tasks require coordination and collaboration among work unit members to resolve communication problems of low analyzability.

Based on the preceding observations, a somewhat subjective scenario follows. VM is used asynchronously to request information from others within horizontally differentiated work units and across vertically differentiated organizational levels. The information returned may be in the form of a voice message, or in other more conventional forms (e.g., synchronous phone call, memo, etc.). The communication is more likely sequential, and initiated by the supervisor, in vertical relationships. The returned message increases one's ability to obtain information that, in turn, leads ultimately to an increased ability to distribute information. Due to the need for coordination and collaboration to establish common interpretations and shared information in low analyzable task environments, an ability to subsequently distribute information, perhaps to delegate a task to a set of subordinates or to integrate work unit liaisons, is highly salient.

One practical implication of these findings is that VM can apparently support tasks needing coordination, particularly in less analyzable task requirements. A related implication is that implementors should distinguish between voice answering and voice messaging, and encourage organizational members of the potential of messaging capabilities. Voice mail has great potential as a common, accessible communication tool, contingent on organizational structural factors and task requirements.

## REFERENCES


Beswick, R., & Reinsch, N., Jr. (1987). Attitudinal responses to voice mail. *The Journal of Business Communication, 24*(3), 23–25.

Burgelman, R., & Sayles, L. (1986). *Inside corporate innovation: Strategy, structure, and managerial skills.* New York: Free Press.

Burns, T., & Stalker, G. (1961). *Management of innovation.* London: Tavistock Publications.

Chevreau, J. (1986). Voice technology gets vocal. *Canadian Datasystems, 18*(3), 76–79.

Crawford, D. (1986). New face of finance; All talk and action. *Wall Street Computer Review, 3* (11), 40–48.

Daft, R., & Lengel, R. (1986). Organizational information requirements, media richness, and structural design. *Management Science, 32*(5), 554–571.

Fayol, H. (1949). *General industrial management.* London: Pittman.

Fennel, K. (1986). Electronic mail: Putting the tag on phones. *ComputerData, 11*(10), 15.





Galbraith, J. (1973). *Designing complex organizations.* Reading, MA: Addison-Wesley.

Goldstein, M. (1986). Send a message, now! *Industry Week, 230*(2), 43–46.

Goodman, G., & Abel, M. (1987). Communication and collaboration: Facilitating cooperative work through communication. *Office: Technology and People, 3,* 129–146.

Hafner, K. (1986). Hello voice mail, goodbye message slips. *Business Week, 2951,* 80.

Henricks, M. (1985). Miraculous messaging. *Dun's Business Month, 125*(1), 90, 92.

Hiltz, S. R. & Turoff, M. (1978). *The network nation.* Menlo Park, CA: Addison-Wesley.

Huber, G. (1984). The nature and design of post-industrial organizations. *Management Science, 30*(8), 928–951.

Hurt, H., Joseph, K., & Cook, C. (1977). Scales for the measurement of innovativeness. *Human Communication Research, 4*(1), 58–65.

Katz, R., & Tushman, M. (1979). Communication patterns, project performance, and task characteristics: An empirical evaluation in an R&D setting. *Organizational Behavior and Human Performance, 23,* 139–162.

Keller, R. (1986). Predictors of the performance of project groups in R&D organizations. *Academy of Management Journal, 29,* 715–726.

Kiesler, S., Siegel, J., & McGuire, T. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist,* October, 1123–1134.

Kondo, D. (1985). Voice mail system service and maintenance: What's hot, what's not. *Communication Age, 2*(2), 30–32.

Lawrence, P., & Lorsch, J. (1967). *Organization and environment: Managing differentiation and integration.* Boston: Graduate School of Business Administration, Harvard University.

Markus, M. L. (1987). Toward a critical mass theory of interactive media: Universal access, interdependence and diffusion. *Communication Research, 14,* 491–511.

Matthews, G. (1985). Bright future for corporate communications. *Telecommunication Products and Technology, 3*(6), 66, 68.

Moore, I. (1986). Cellular carriers to reap VS&F benefits. *Telephone Engineer and Management, 90*(15), 61–63.

Nicholson, R. (1985). Usage patterns in an integrated voice and data communications system. *ACM Transactions on Office Information Systems, 3*(3), 307–314.

Parker, M. (1987). *The practical guide to voice mail.* New York: McGraw-Hill.

Paznik, J. (1987). Voice mail: Pitfalls and promises. *Administrative Management,* March, 16–25.

Perrow, C. (1972). *Complex organizations: A critical essay.* Glenview, IL: Scott, Foresman.

Pfeiffer, G. (1986). A special delivery message for cellular. *Cellular Business, 3*(11), 16–24.

Pollack, B. (1985). Using voice mail is a easy as telephoning. *Management Technology, 2*(12), 10–14.

Pool, I. (1977). *The social impact of the telephone.* Cambridge, MA: MIT Press.

Reinsch, N., Jr., & Beswick, R. (1988). *Initial effects of voice mail: An abstract.* Paper presented to the Office Systems Research Association, Denver, CO.

Rice, R. E. (1980). Impacts of organizational and interpersonal computer-mediated communication. In Williams, M. (Ed.), *Annual review of information science and technology* (Vol. 15, pp. 221–249). White Plains, NY: Knowledge Industry Publications.

Rice, R. E. (1987). Computer-mediated communication systems and organizational innovation. *Journal of Communication, 37*(4), 65–94.

Rice, R. E., & Associates. (1984). *The new media: Communication, research and technology.* Beverly Hills, CA: Sage Publications.

Rice, R. E., & Bair, J. (1984). New organizational media and productivity. In R. E. Rice & Associates, *The new media: Communication, research and technology* (pp. 185–215). Newbury Park, CA: Sage Publications.

Rice, R. E., & Borgman, C. (1983). The use of computer-monitored data in information science and communication research. *Journal of the American Society for Information Science, 34,* 247–256.

Rice, R. E., Grant, A., Schmitz, J., & Torobin, J. (in press). Individual and network influences on the adoption and perceived outcomes of electronic messaging. *Social Networks.*

Rice, R. E., & Love, G. (1987). Electronic emotion: A content and network analysis of a computer-mediated communication network. *Communication Research, 14*(1), 85–108.

Rice, R. E., & Shook, D. (1990). Relationships of job categories and organizational levels to use of communication channels, including electronic mail: A meta-analysis and extension. *Journal of Management Studies, 27*(3).

Rice, R. E., & Shook, D. (1988). Usage of, access to, and outcomes from an electronic messaging systems. *ACM Transactions on Information Systems, 6,* 255–276.

Ruprecht, M., & Wagoner, K. (1986). Technological advances in the office of the future. *Modern Office Technology, 31*(5), 16–22.

Shook, D. (1988). *A structural equivalence and contingency theory perspective on media usage and communication performance: The case of voice messaging.* Unpublished doctoral dissertation, University of Southern California.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications.* London: Wiley.

Stewart, C. (1985). *Voice messaging: An annotated bibliography of the literature.* Working Paper 85-02. Piscataway, NJ: AT&T Communications Technology and Productivity Research Center.

Thompson, J. (1967). *Organizations in action.* New York: McGraw-Hill.

Town, R. (1983). Voice store and forward, its evolution. *Interface '83 Proceedings, 11th Annual Interface Meeting, Miami Beach.* New York: McGraw-Hill.

Trevino, L., Lengel, R., & Daft, R. (1987). Media symbolism, media richness and media choice in organizations: A symbolic interactionist perspective. *Communication Research, 14*(5), 553–575.

Withey, M., Daft, R., & Cooper, W. (1983). Measures of Perrow's work unit technology: An empirical assessment and a new scale. *Academy of Management Journal, 26,* 45–63.

Woodward, J. (1956). *Industrial organization: Theory and practice.* London: Oxford University Press.