Association for Information Systems
AIS Electronic Library (AISeL)

ICIS 1990 Proceedings

International Conference on Information Systems (ICIS)

1990

THE DESIGN OF COMPUTER BASED SUPPORT FOR TASK COMMUNICATION WITHIN ORGANIZATIONS

Surinder Singh Kahai
University of Michigan

Randolph Cooper
University of Houston

THE DESIGN OF COMPUTER BASED SUPPORT FOR TASK COMMUNICATION WITHIN ORGANIZATIONS

Surinder Singh Kahai
School of Business Administration
University of Michigan

Randolph Cooper
College of Business Administration
University of Houston

ABSTRACT

Task communication plays an important role within organizations, facilitating the conversion of inputs to outputs and the coordination and control of internal activities. An important function of several computer based information technologies is to support task communication. However, information systems designers do not have a framework that can help them select information technology that will provide efficient and effective communication support. This paper integrates the organization and information systems literatures in order to develop guidelines for the selection of appropriate communication support technology.

1. INTRODUCTION

Organizations use task communication to convert their inputs to outputs and to coordinate and control internal activities (O'Reilly and Pondy 1979; Weick 1985). Managers have been found to spend between 40 and 90 percent of their time communicating (Mintzberg 1973) while technical and professional employees have been reported as spending 63 percent of their time communicating (Montgomery and Benbasat 1983). The increasing complexity and turbulence of organizational environments can only be expected to increase the demands for such information exchange (Huber 1984). The design of communication support systems to facilitate communication within organizations is, therefore, an important issue for organization design.

Computer mediated communication systems (CMCS) (Hiltz and Turoff 1985; Rice 1987) such as computer conferencing systems, electronic mail and voice mail systems, group decision support systems (GDSS), and text retrieval systems have been designed explicitly to support communication in organizations (Huseman and Miles 1988; Meadows 1967). Besides these technologies, data processing systems and expert systems which communicate information from one or more persons to others can also be regarded as CMCS (Huseman and Miles 1988; Prietula and Simon 1989). For example, an order processing system that transmits orders from the order entry office to the warehouse facilitates task communication. Similarly, expert systems establish communication from a set of experts to task performers.

A major objective behind the design of CMCS is to enhance the efficiency and effectiveness[1] of task communication in organizations. However, some studies have reported organizational situations in which CMCS have tended to be *ineffective*. It follows from the arguments of Markus and Robey (1983) and Daft and colleagues (see Daft and Wiginton 1979; Daft and Macintosh 1981; Daft, Lengel and Trevino 1987) that an important reason behind the ineffective performance of a CMCS in any organizational context is the lack of "organizational validity"; that is, the lack of a fit between the information processing supported by the CMCS and the information processing requirements for the context in question. The implementation of an ill-fitting communication system can lead to *ineffective* performance through the following (Daft and Lengel 1984; Daft, Lengel and Trevino 1987):

- Spending more time on processing information than is necessary.
- Misrepresenting the phenomenon or topic of interest.
- Conflict resulting from the inability to resolve differences in frames of references.
- Extraneous information tending to take the attention away from or distorting the original message.

The principle of organizational validity is, therefore, an important consideration for the design of CMCS in any organizational context. In order to develop CMCS design guidelines that are based on this principle, an organizational communication framework is needed to characterize organizational contexts and CMCS and relate these organizational contexts to appropriate CMCS (Daft, Lengel and Trevino 1987). As described below, a review of information systems and organization theory literatures reveals that there is no framework that fits these requirements. This paper takes a step toward developing such an organization communication framework. We hope that this framework will serve information systems researchers as the much needed basis for developing theory related to CMCS use in organizations (Steinfield and Fulk 1987) and ultimately lead to CMCS design guidelines.

2. LITERATURE REVIEW

Previous IS design frameworks are of little help in developing an organizational communication framework. For example, traditional MIS and data processing frameworks such as Business Systems Planning (IBM 1978) help identify structured and predictable flows of information and thus are of little use for electronic mail systems, electronic conferencing systems, and GDSS. Decision support systems design frameworks are oriented toward individual decision making in semistructured or unstructured decision situations and typically ignore the issue of organizational communication.

There is considerable work by information systems researchers focussed specifically on CMCS. One stream of this work looks at the technical features of CMCS while ignoring the relationship of CMCS to organizational contexts. The other stream compares electronic mail systems, voice mail systems, electronic conferencing systems, and GDSS to non-computer communication support systems on the basis of the following dimensions:

- time required to make a decision;
- quality of the decision reached;
- participation in decision making;
- amount of nonverbal cues transmitted;
- task orientation of information exchanged, i.e., more task oriented versus less task oriented;
- total time spent in accomplishing communication;
- satisfaction of participants in decision making;
- whether a consensus has been reached or not; and
- confidence related to the decision reached.

However, this work has failed to develop a theoretical basis for relating organizational contexts to the *effective* use of CMCS (Steinfield and Fulk 1987).

The design of communication support systems within organizations has also received attention from organization theorists. However, they typically ignore the communication capabilities of computer based systems (Randolph 1978; Tushman 1979) or conceptualize them very narrowly (Van de Ven, Delbecq and Koenig 1976; Daft and Lengel 1986). In the latter case, the role of information systems in supporting communication is thought of as providing standard reports (Daft and Lengel 1986) or communicating standard messages within subunits that have routine tasks (Van de Ven, Delbecq and Koenig 1976). Organization theorists have, therefore, provided very limited help toward the design of *effective* CMCS.

In this section, we have argued that both the information systems and organizational theory literatures do not provide a theoretical framework that facilitates the design of *effective* CMCS. Based on the organizational information processing perspective (Galbraith 1973, 1977), the next section develops such a framework.

3. FRAMEWORK DEVELOPMENT

The information processing perspective has been found useful for theorizing about the *effectiveness* of (largely) non-computer mediated communication systems in different organizational contexts. social systems consisting of individuals engaged in gathering, transforming, synthesizing, exporting, and receiving information to solve problems regarding the conversion of inputs to outputs and to coordinate internal activities. In order to ensure *effective* performance, an organization adopts a structure such that there exists a "fit" between the capacity of the structure to process information and the organization's information processing requirements (Tushman and Nadler 1978). As Figure 1 shows, organizational task characteristics such as frequency of exceptions and task analyzability affect the amount and nature of an organization's information processing requirements. The information processing capacity of the organization, on the other hand, is affected by the organization's structure. Organization structure is the allocation of tasks and responsibilities to individuals and groups within the organization and the design of systems to ensure effective communication and integration of effort (Child 1977). More specifically, this structure refers to mechanisms for problem solving and coordination of effort.

Our focus is on communications rather than information processing in general. Thus an organization's information communication requirements are matched to the appropriate information communication capacity as illustrated in Figure 2. An organization's communication requirements result from the same task characteristics as the more general information processing requirements. In addition, an organization's communication capacity depends upon the communication systems employed (such as electronic mail) which are part of an organization's structure. In order to evaluate an organization's communication requirements-capacity fit, a set of communication dimensions must first be defined.

3.1 Communication Dimensions

The information processing view of organizations discusses communication in terms of personalization, language variety, multiple cues, availability of feedback, and interlocked behavior cycles. For this paper, we have excluded personalization, adapted the remaining dimensions, and borrowed a dimension from CMCS research to arrive at the following four dimensions which we feel are useful for distinguishing among communication processes and communication systems.

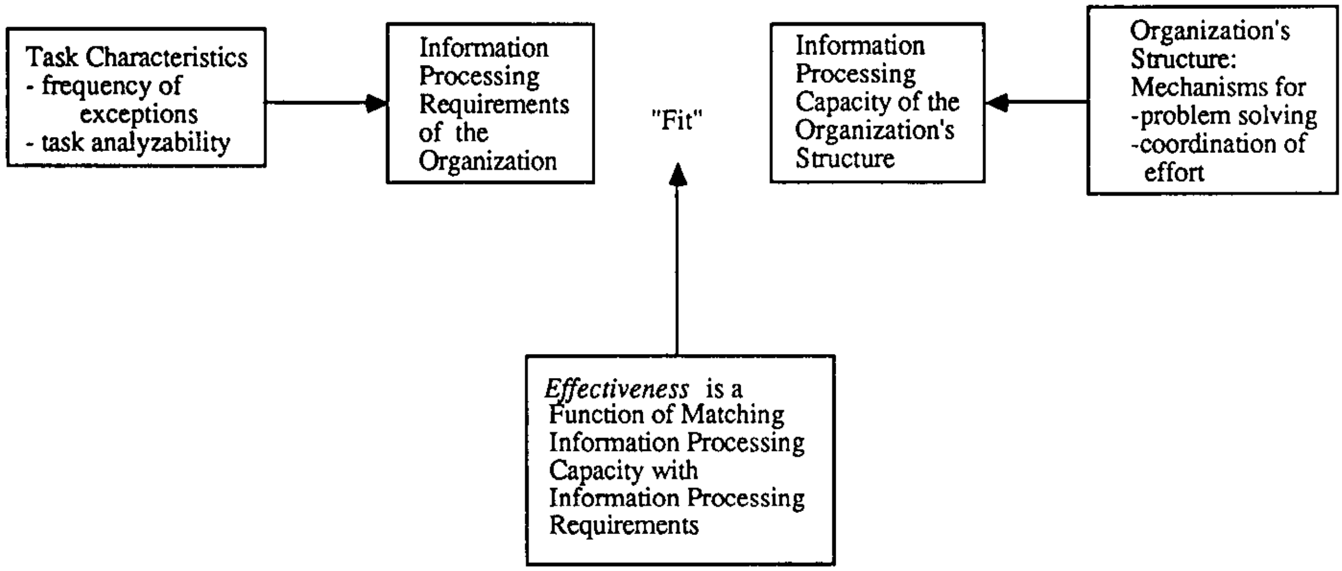

Figure 1. The Information Processing Model of an Organization (adapted from Tushman and Nadler 1978)

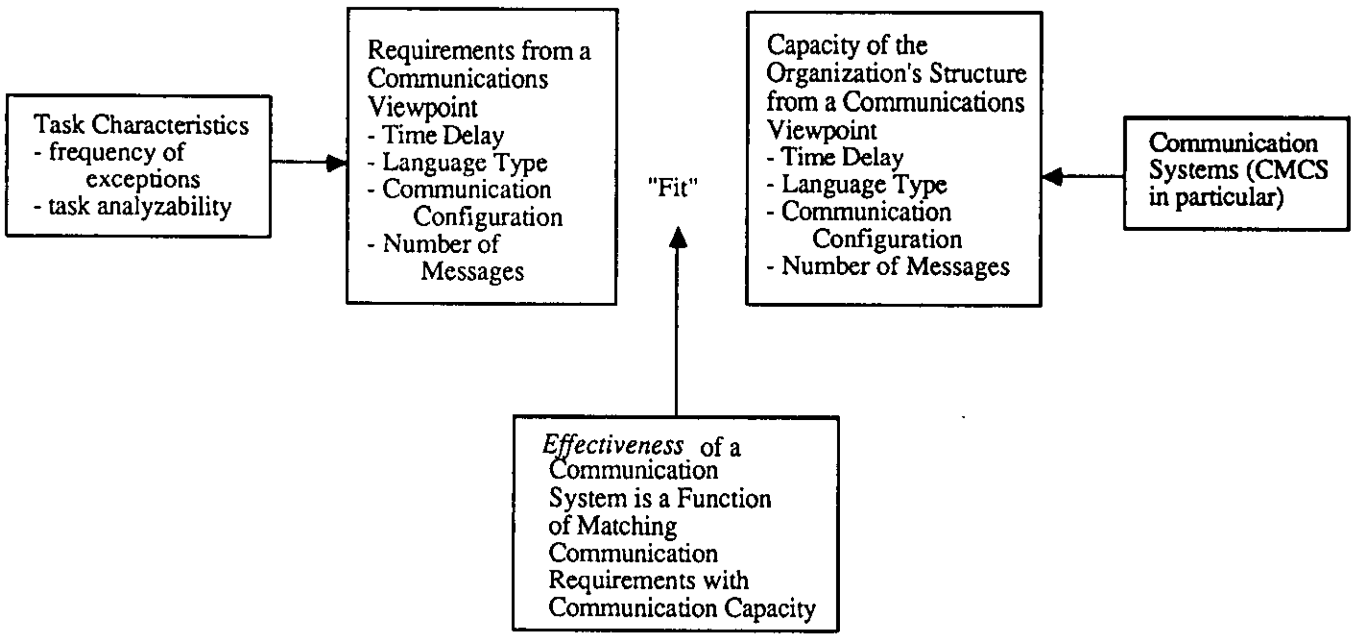

Figure 2. Organizational Communication Model (adapted from the information processing model of an organization - Tushman and Nadler 1978)

3.1.1 Time Delay

Any flow of messages has a time aspect to it. This dimension extracts the time aspect from the notion of "availability of feedback" during communication advanced by Daft and colleagues (see Daft and Lengel 1984, 1986; Daft, Lengel and Trevino 1987). Availability of feedback captures two ideas simultaneously: ad hoc responsiveness and time delay. Ad hoc responsiveness is represented below by language type and communication configuration. Time delay captures the following notions. With *delayed communication*, the message is not directly sent to its ultimate receivers but is stored with the idea that it will be retrieved by the receivers when needed. With *real time communication*, no storage of this type is intended and the message is sent directly to its receivers. Real time communication can be broken down further into synchronous and asynchronous communication (Culnan and Markus 1987).

An example of delayed communication is that which occurs when a store clerk captures the sales data to store it in a database and the same data is retrieved later in an aggregated form by the store manager. One person asking a question of another while walking down the corridor is an example of synchronous real time communication. Sending a note to someone through office mail requesting her/him to expedite a customer's order is an example of asynchronous real time communication. Even though there is a significant time delay between the time the message is sent and the time when it is received, this note illustrates non-delayed communication because there is no intentional storage until the time the receiver needs the information.

3.1.2 Language Type

Any communication involves the use of some language. This dimension refers to the type(s) of languages used in the communication process (adapted from Daft, Lengel and Trevino 1987; Daft and Wiginton 1979). At a general level, Daft and Wiginton identified nine different types of languages: art, nonverbal cues, poetry, general verbal expression, jargon (special language of accountants, engineers, etc.), linguistic variables (semantic differential, Likert scale), computer languages, probability theory, and analytical mathematics.

3.1.3 Communication Configuration

Communication involves two or more actors. The communication configuration dimension describes how messages flow among the actors. This dimension is adapted from the ideas of connectivity and type of communication seen in Culnan and Markus (1987), Fanning and Raphael (1986), and Montgomery and Benbasat (1983). Figure 3 identifies and provides examples of the different types of communication configurations.

3.1.4 Number of Messages

Communication processes vary in terms of the number of messages during a specific problem solving process. Here a message refers to any uninterrupted set of statements made by a communicator. This dimension captures this idea and is adapted from the notion of interlocked behavior cycles proposed by Weick (1979). For example, the announcement of a new sales policy through a memo is a single message. A communication process made up of someone asking for some data and the corresponding reply to the request involves two messages while an extended discussion between individuals involves many messages. This dimension is somewhat related to the communication configuration dimension because the number of messages is always few for one-to-one, one-to-many, many-to-one, and many-to-many communication. For the remaining configurations, the number of messages could vary from few to many.

These communication dimensions are employed in the next section to describe the impact of task characteristics on an organization's communication requirements.

Types of Communication Configurations	Examples
One to One	Issuing an order to a subordinate
One with One	Communicating with someone to seek the solution to a problem
One to Many	Sending a memo to organizational members informing them about a change in some organizational policy
Many to One	Salespersons sending their weekly reports to sales manager
One with Many	Communicating with subordinates with the help of a questionnaire which seeks their reactions to a new organizational policy
Many to Many	Order entry clerks communicating orders to several shipping and handling clerks
Many with Many	The use by several organizational members of a procedures manual to which different authors have contributed different procedures
All with All	Discussion in a group meeting

Figure 3. Types of Communication Configurations

3.2 Effect of Task Characteristics on Communication Requirements

In this section we restrict our examination to the effect of two task variables – frequency of exceptions and task analyzability – on communication requirements in an organization. Frequency of exceptions refers to the extent to which the required response to a task situation is new (Perrow 1967). A task response is defined as new to the extent the information processing required is different from that for previous tasks. For example, the frequency of exceptions for an engineer in a custom design unit is high while that for an order entry clerk is low.

Task analyzability is defined as the extent to which the task can be performed by identifying an appropriate framework and relevant data available in one or more communicable knowledge bases (adapted from Daft and Macintosh 1981; Macintosh 1981; Silver, Cohen and Rainwater 1988).

These knowledge bases consist of (1) institutional knowledge, i.e., common sense knowledge, knowledge used by professionals such as engineers and accountants, and descriptive and procedural knowledge pertaining to any area of conduct institutionalized by an organization (Berger and Luckmann 1967; Meyer and Rowan 1977), and (2) any personal but communicable knowledge base.

Frequency of exceptions and task analyzability can be dichotomized and combined to give a four cell structure originally proposed by Perrow (1967) and shown in Figure 4. This structure highlights four task archetypes: routine tasks, technical-professional tasks, craft type tasks, and unstructured tasks. Routine tasks, such as the work of an order entry clerk, are characterized by few exceptions and high analyzability. Most of the task situations repeat themselves and communicable procedures exist to handle them. Technical-professional tasks, such as those of an engineer or a tax accountant are characterized by several exceptions and high analyzability. Here, a communicable knowledge base is available to refer to and respond to a variety of task situations. Craft type tasks are characterized by few exceptions and low task analyzability. Most of the task situations have been encountered before and *inarticulable* experiential knowledge is used to respond to the task situation. Examples of craft type tasks are tasks of experts who make fine glassware, money market managers, and tea tasters. Unstructured tasks are largely unique tasks for which no appropriate framework is available in any communicable knowledge base. Rather, a framework is constructed in response to task situations. Examples of unstructured tasks include strategy and policy formulation.

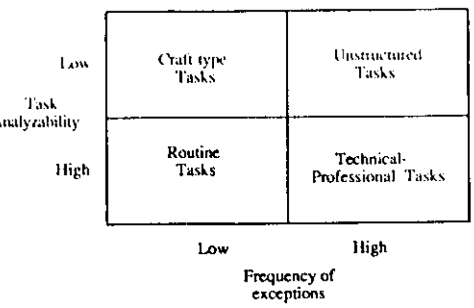

Figure 4. Categories of Tasks

As summarized in Figure 5, we now look at each of the four task categories and determine the corresponding communication requirements. We restrict our analysis to communication requirements necessary for problem solving rather than coordination. Thus, for example, communication of a customer order from an order entry clerk to a shipping clerk is ignored while communication about how to execute the order taking task is of interest.

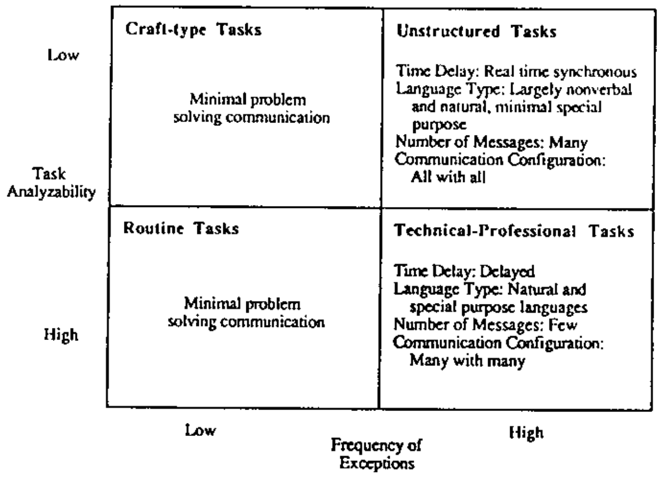

Figure 5. Communication Requirements for Tasks

3.2.1 Routine Tasks

Routine tasks are repetitive and communicable programs exist to handle them. For example, the work of an order entry clerk is repetitive and a program consisting of a series of steps followed by the clerk is available. Often the programs used to handle routine task situations are developed and implemented by the organization (March and Simon 1958). Programs are an effective mode of information processing here because there are few exceptions which require new responses. When exceptions occur, they are handled by referring them upward in the hierarchy (Galbraith 1973, 1977). For this paper, we assume a state in which the task performer has learned all the relevant programs. Therefore, there is little need for problem solving communication. Non-exceptional tasks communication is that pertaining to managing the work flow from one organizational member to another. This coordination communication is not the focus of this paper. Thus there are no communication requirements of interest for routine tasks.

3.2.2 Craft Type Tasks

Most craft type tasks are not exceptional but the conversion of inputs to outputs at the highest level of task performance (known as expert level performance) does not follow from any framework that can be identified in some articulable knowledge base. The expert performer acquires the task knowledge through practice, often over a period of several years, and is generally unable to articulate it.

In contrast to routine tasks, the inability to articulate expert level knowledge implies that organizations cannot develop and implement programs that enable expert level performance. The handling of craft type task situations is thus left to the discretion of experts (Stinchcombe 1959).

The exceptions are handled through discussions among experts with shared experiences (Daft and Lengel 1986). Again, as in the case of routine tasks (but for different reasons), there is little communication pertaining to problem solving that occurs for expert level performance of craft type tasks.

3.2.3 Technical-Professional Tasks

Technical-professional tasks are characterized by a high number of exceptions and high task analyzability. Frameworks and data to respond correctly to the task situations are available in institutional knowledge bases. The information processing to convert inputs to outputs is performed by professionals who have received specialized training in the application of the relevant institutional knowledge to organizational problems.

When a task situation arises, the relevant knowledge has to be accessed. There are two strategies available to the task performer for accessing the relevant knowledge. The task performer may try to retrieve the knowledge from the knowledge base on his own or may ask someone for the required knowledge or for the location of the required knowledge (March and Simon 1958; O'Reilly 1982). Both these strategies entail communication. In this paper, we will focus on the communication requirements for the former strategy.

By design, **delayed communication** is involved. The task performer has to retrieve knowledge that has been prepared by one or more authors and stored in a communicable knowledge base. The types of languages used to communicate the knowledge are **natural and special purpose (such as mathematical) languages**; nonverbal cues may distract the receiver's attention from the task and may also disagree with the spoken message thereby causing confusion (Culnan and Markus 1987; Daft and Lengel 1984). A **low number of messages** are involved. This is because the language for typifying a task situation or parts of it is available and taught to professionals during their training (Berger and Luckmann 1967); this facilitates systematic labeling and retrieval of the relevant knowledge. Once the knowledge base is available, the relevant knowledge can be retrieved with an exchange of few messages with the knowledge base. There are usually several authors and users of the knowledge base. However, there is no communication involved between the authors or the users and, therefore, a **many with many** as opposed to all with all communication configuration is involved.

3.2.4 Unstructured Tasks

Unstructured tasks are unique tasks for which one is not able to identify an appropriate problem solving framework and relevant data available in any communicable knowledge base. Also, knowledge of the type possessed by experts is lacking since such knowledge can only be formed by a fairly long period of experience in a situation where tasks repeat themselves (Mills 1925 [1842]; Prietula and Simon 1989).

According to Daft and colleagues (1986; 1987) and Silver, Cohen and Rainwater (1988), effective handling of such task situations requires **all with all communication**. All with all communication is important for the following reasons. In unstructured situations, an individual's response is influenced more by internal factors (such as his attitudes, identifications, past learning, language, commitments, and momentary as well as permanent interests) and social influences (such as words, actions, or communications of other individuals, groups, and mass media) than by objective characteristics of the topic, phenomenon, or stimulus of interest (Sherif and Sherif 1969). Because experience is a major source of information used to respond to the task in unstructured situations, the scope of information processed is also limited by one's experiences (Lawrence and Lorsch 1967; Maier 1970). As a result, when a single individual responds to an unstructured task, the following occur: problems may be formulated narrowly leading to consideration of too few alternatives, relevant arguments pertaining to alternatives being considered may not be identified, and judgments about relationships may be erroneous.

The narrow formulation, generation of few alternatives, and inability to consider all relevant arguments result from the limited scope of the knowledge an individual possesses and from an individual's inability to retrieve from her/his mind all knowledge that has a bearing on the situation (Maier 1970). When a group is used to process information, members bring in diverse perspectives; what is left out by one person (in terms of problem formulation, alternatives, and relevant arguments) is registered and/or pushed by another. Also, the effect of erroneous judgments is reduced because everyone does not make the same error and the errors are scattered (March and Simon 1958). Thus, an all with all communication configuration is vital for effective responses to unstructured tasks.

In addition to all with all communication, Daft and colleagues (1986; 1987) suggest that **nonverbal cues** are important for unstructured tasks. This importance can be understood through an extension of Zadeh's principle of incompatibility (1973). According to this principle, in order to be meaningful, statements about ambiguous phenomena must be ambiguous themselves. This is reasonable since unambiguous statements about ill-defined systems convey a clear understanding where in fact none exists. (March [1978, pg. 603] proposes a version of this principle in what he calls as the optimal clarity problem.)

Different languages differ in terms of their ability to convey ambiguity. Figure 6, taken from Daft and Wiginton (1979), orders the different communication languages along a continuum that reflects their ability to convey ambiguity: mathematical and computer languages rate very low, art and nonverbal cues rate very high and natural language is in between (Mehrabian 1972). Thus, given the low analyzability for unstructured tasks, effective performance requires ambiguous information processing. Natural language by itself will be inadequate for conveying the desired level of ambiguity and, hence, it should be complemented with nonverbal cues (given that art or poetry is not a common way to communicate ideas in organizations) (Daft and Lengel 1984) which can be communicated only in face-to-face interaction. Special purpose languages such as mathematics will be of limited use because of their inability to communicate ambiguity adequately for unstructured tasks (Daft and Wiginton 1979).

When a situation is not well understood, a **large number of messages** are needed to reach some reasonable interpretation (Weick 1979). In such situations, there are a large number of interpretations that cannot be ruled out using established knowledge. To increase the chances of reaching the most reasonable interpretation, a large number of messages are used with one or more messages attending to each potential interpretation. Another contributor to the number of messages is the need to be ambiguous in one's communication. Ambiguity in any communication leads its receivers to seek clarification about its meaning and thus increases the number of messages.

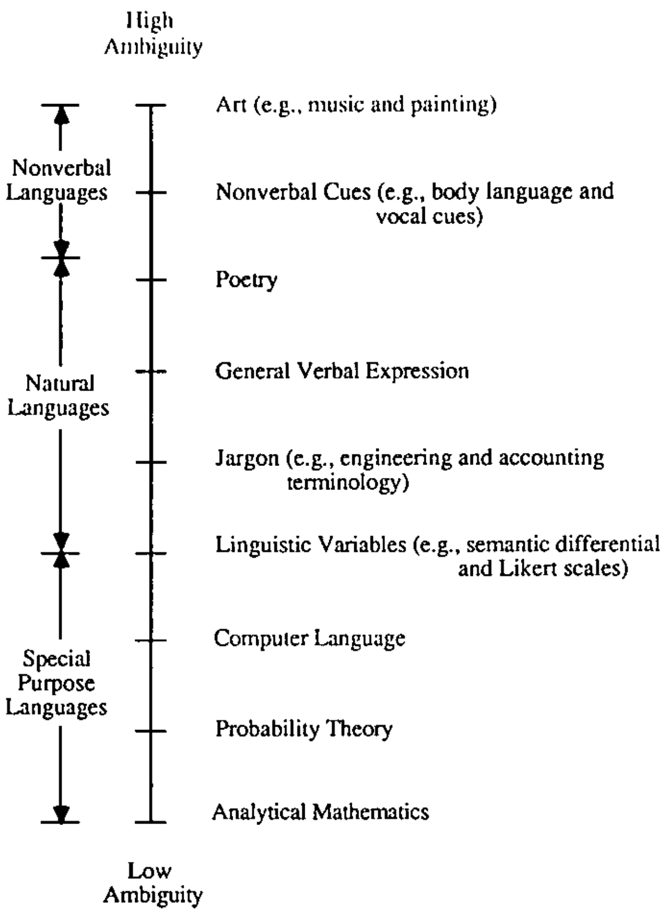

Figure 6. Ordering of Languages Along the Ambiguity Continuum

Asynchronous real time processing coupled with many cycles will not be effective in such situations because the information processing may extend over a long period of time and thus result in untimely action. Asynchronous real time processing is also likely to be inefficient (see Crawford 1982) in comparison to synchronous real time processing because of the repeated occurrences of the fixed costs of setting up the communication process each time one sends or receives a message. For example, there are fixed costs of mailing and receiving a memo each time; there are also costs of establishing the context of communication each time a memo is sent or received. Therefore **synchronous real time communication** is likely to be most *effective* for unstructured tasks.

3.3 Characterization of Computer Mediated Communication Systems

Computer mediated communication systems facilitate communication processes and include data processing systems, electronic mail systems, voice mail systems, electronic conferencing systems, expert systems, text retrieval systems, and face-to-face group decision support systems. For illustrative purposes, we will focus on text retrieval systems, electronic mail systems, and face-to-face group decision support systems. The following discussion characterizes these systems on the basis of time delay, language type, number of messages, and communication configuration dimensions in order to facilitate the fitting of appropriate CMCS with an organization's communication requirements. Figure 7 provides a summary of these characteristics.

	Text Retrieval	Electronic Mail	Face-to-face GDSS
Time Delay	Delayed	Real time asynchronous	Real time synchronous
Language Type	Natural and special purpose	Natural and special purpose	Nonverbal, natural, and special purpose
Number of Messages	Few to many	Few	Many
Communication Configuration	Many with many	All except many with many	All with all

Figure 7. Characteristics of CMCS

3.3.1 Text Retrieval System

Text retrieval systems provide computer based support for the storage and retrieval of textual information. These systems enable complex queries to be made concerning the content context, originator, etc., of a firm's documents (Blair and Maron 1985) and may incorporate artificial intelligence techniques to enhance text retrieval effectiveness (Croft and Lewis 1987; Gordon 1985). Text retrieval systems support **delayed communication**; documents are stored prior to use with the intention that they will be retrieved as and when needed by a user. Its textual nature restricts language handling to **natural and special purposes (e.g., mathematical) languages**, eliminating the potential for nonverbal cues. The multiauthor and multiuser nature of these systems reflects a **many with many** communication configuration. The number of messages supported ranges from few to many; a high number of messages occurs in the case of a protracted dialogue between the user and the system.

3.3.2 Electronic Mail

An electronic mail system supports a **real time asynchronous communication** process: a message sent by someone is not received by its intended receivers at the same time at which it is sent. However, the communication is not delayed because the message is sent with the intention that it be retrieved as soon as possible by its receivers. With its textual nature, **natural and special purpose (such as mathematical) languages** are supported but nonverbal cues are not. The flexibility in terms of senders, receivers, and directionality supports **all types of communication configurations except for many with many.** Communication tends to be restricted to broadcast of messages or short interactive exchanges. With its asynchronous nature, facilitating an exchange of many messages requires some kind of linking between messages along any topic to allow easy access to the history of exchanges. This feature is typically not available on electronic mail systems and thus the **number of messages** supported is few.

3.3.3 Face-to-face GDSS

Face-to-face GDSS refers to computer based support for face-to-face meetings. This support includes features which overcome communication barriers such as allowing anonymous input (DeSanctis and Gallupe 1987), imposing communication patterns such as not allowing idea evaluation before idea generation (Stefik et al. 1987), facilitating the use of group structuring techniques such as the Nominal Group Technique (DeSanctis and Gallupe 1987), and providing symbolic logic modelling tools (Mitroff and Mason 1980). In addition, access to and display of data in databases as well as the simultaneous creation, manipulation, and viewing of mathematical models may be permitted.

Face-to-face GDSS support **real time synchronous communication processes.** With aspects of both face-to-face and computer based communications, the use of **all types of languages** is enabled. An **all with all communication configuration** is supported and an exchange consisting of anywhere from **few to many messages** is supported.

4. DISCUSSION

By describing both communication processing requirements and CMCS in terms of a common set of communication dimensions, one can identify the organizational validity of various kinds of CMCS. The communication characteristics of text retrieval, electronic mail, and face-to-face GDSS are evaluated below to determine their relative fit (organizational validity) for technical-professional and unstructured tasks.

Comparing Figure 5 to Figure 7, we see that there is a good fit between the communication requirements for technical-professional tasks and the communication capabilities of text retrieval systems. The requirements consist of delayed communication, natural and mathematical languages, an exchange of few messages, and a many with many communication configuration. Text retrieval system capabilities support all of these requirements. Another good fit is demonstrated between unstructured tasks and face-to-face GDSS. Both the task requirements and the communication capabilities are in accord with the following characteristics: real time synchronous communication; non-verbal, natural, and, to a limited extent, special purpose languages; all with all communication configuration; and many messages exchanged.

Electronic mail is an example of a communication support system that does not fit the requirements of either task type. In the case of unstructured tasks, the communication of many messages asynchronously would inhibit timely action. The absence of nonverbal cues restricts the ambiguity one can convey about the phenomenon of interest. Even though all with all communication can be supported, in the absence of linking between messages along topics, an exchange of only few asynchronous messages along any topic is supported.

By design, electronic mail supports real time communication whereas delayed communication is suitable for acquiring the desired knowledge from technical-professional knowledge bases. Electronic mail meets the requirements of natural and special purpose languages and few number of messages for technical-processional tasks but does not satisfy the requirement of many with many communication.

These three examples illustrate that the organization communication model developed in this paper can distinguish among tasks and among CMCS as well as identify intuitively appealing mappings between the communication requirements of tasks and the appropriate CMCS. Though based in organization theory, the evidence of this model's usefulness is currently limited to an intuitive level. No claim is made that the communication dimensions or the task categorizations are complete. Several dimensions such as, for example, personalization (Daft and colleagues 1986; 1987), the extent to which the communication process involves information manipulation (i.e., aggregation, transformation, or sorting) (Nass and Mason 1990), or the extent to which it involves pictures have not been included. The importance of the latter dimension is likely to increase with advances in multimedia technology.

In this paper, we have restricted ourselves to dimensions whose extreme values are neither universally desirable or undesirable. The desirability or undesirability of any extreme value on any dimension depends on the situation. For example, along the dimension of language types, the presence of nonverbal cues in any communication is not theorized as universally desirable or undesirable. Nonverbal cues are theorized as useful for unstructured tasks and harmful for routine and technical-professional tasks. We have, however, not included dimensions whose extremes are either universally desirable or undesirable such as, for example, the input time (i.e., the time spent on all activities related to transferring the message to be communicated to an appropriate transmission medium) and time spent on shadow functions (i.e., time spent on unpredictable and unproductive activities when one wants to communicate with someone as in the case of, for example, telephone tag) (Montgomery and Benbasat 1983). These universalistic dimensions reflect various costs and benefits of using any communication system and would be useful for resolving ties between systems that match the communication requirements defined as per the non-universalistic dimensions considered in this paper.

The next steps in this research program include validating that fit as defined in our model does indeed lead to *effective* communication and developing a more comprehensive model in terms of organizational tasks and associated communication requirements, communication systems and associated capacities, communication dimensions with finer metrics and weightings, incorporating the costs of developing, implementing, and maintaining the communication systems into the notion of organizational fit, and including coordination communication along with the problem solving communication described in this paper.

5. ACKNOWLEDGMENT

The authors wish to thank the anonymous reviewers for their very helpful comments.

6. REFERENCES

Berger, P. L., and Luckmann, T. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge.* Garden City, New York: Doubleday, Anchor Books, 1967.

Blair, D., and Maron, M. "An Evaluation of Retrieval Effectiveness for a Full Text Document Retrieval System." *Communications of the ACM*, Volume B28, March 1985, pp. 289-299.

Child, J. *Organizations: A Guide to Problems and Practice.* Harper and Row, New York, NY, 1977.

Crawford, A. "Corporate Electronic Mail – A Communication-Intensive Application of Information Technology." *MIS Quarterly*, September 1982, pp. 1-13.

Croft, W. B., and Lewis, D. "An Approach to Natural Language Processing for Document Retrieval." In *Proceedings of the Tenth Annual ACM SIGIR Conference on Research and Development in Information Retrieval*, 1987, pp. 26-32.

Culnan, M. J., and Markus, M. L. "Information Technologies". In F. M. Jablin, L. L. Putman, K. H. Roberts, L. W. Porter (eds.), *Handbook of Organizational Communication: An Interdisciplinary Perspective*, Beverly Hills, California: Sage Publications, 1987, pp. 420-443.

Daft, R., and Lengel, R. "Information Richness: A New Approach to Managerial Behavior and Organization Design". In B. Staw and L. Cummings (eds.), *Research in Organizational Behavior*, Greenwich, Connecticut: JAI Press, Inc., 1984, pp. 191-233.

Daft, R., and Lengel, R. "Organizational Information Requirements, Media Richness and Structural Design." *Management Science*, May 1986, pp. 554-571.

Daft, R.; Lengel, R.; and Trevino, L. "Message Equivocality, Media Selection, and Manager Performance: Implications for Information Systems." *MIS Quarterly*, September 1987, pp. 355-366.

Daft, R., and Macintosh, N. "A Tentative Exploration into the Amount and Equivocality of Information Processing in Organizational Subunits." *Administrative Science Quarterly*, Volume 26, 1981, pp. 207-224.

Daft, R., and Wiginton, J. "Language and Organization." *Academy of Management Review*, Volume 4, Number 2, 1979, pp. 179-191.

DeSanctis, G., and Gallupe, R. "A Foundation for the Study of Group Decision Support Systems." *Management Science*, Volume 33, May 1987, pp. 589-609.

Fanning, T., and Raphael, B. "Computer Teleconferencing: Experience at Hewlett Packard." In *Proceedings of Conference on Computer-Supported Cooperative Work*, 1986, pp. 291-306

Galbraith, J. *Designing Complex Organizations*. Reading, Massachusetts: Addison-Wesley, 1973.

Galbraith, J. *Designing Complex Organizations*, Second Edition. Reading, Massachusetts: Addison-Wesley, 1977.

Gordon, M. "A Learning Algorithm Applied to Document Description." In *Proceedings of the Eighth Annual ACM SIGIR Conference on Research and Development in Information Retrieval*, Montreal, 1985, pp. 179-186.

Hiltz, S. R., and Turoff, M. "Structuring Computer-Mediated Communication Systems to Avoid Information Overload." *Communication of the ACM*, Volume 28, July 1985, pp. 680-689.

Huber, G. P. "The Nature and Design of Post-Industrial Organizations." *Management Science*, Volume 30, Number 8, August 1984, pp. 928-951.

Huseman, R. C., and Miles, E. W. "Organizational Communication in the Information Age: Implications of the Computer-Based Systems." *Journal of Management*, Volume 14, Number 2, 1988, pp. 181-204.

IBM Corporation. "Business System Planning - The Executive Overview." 1978, 11 pages.

Lawrence, P., and Lorsch, J. *Organizations and Environment*. Cambridge, Massachusetts: Harvard University Press, 1967.

Macintosh, N. "A Contextual Model of Information Systems." *Accounting, Organizations, and Society*, Number 1, 1981, pp. 39-53.

Maier, N. R. F. *Problem Solving and Creativity In Individuals and Groups*. Belmont, California: Brooks/Cole Publishing Co., 1970.

March, J. G. "Bounded Rationality, Ambiguity, and the Engineering of Choice." *The Bell Journal of Economics*, Volume 9, Number 2, 1978, pp. 587-608.

March, J., and Simon, H. *Organizations*. New York: Wiley, 1958.

Markus, M. L., and Robey, D. "The Organizational Validity of Management Information Systems." *Human Relations*, Volume 36, Number 3, 1983, pp. 203-226.

Meadows, C. *The Analysis of Information Systems: A Programmer's Introduction to Information Retrieval*. New York: Wiley, 1967.

Mehrabian, A. *Nonverbal Communication*. Chicago: Aldine-Atherton, Inc., 1972.

Meyer, J. W., and Rowan, B. "Institutionalized Organizations: Formal Structures as Myth and Ceremony." *American Journal of Sociology*, Volume 83, Number 2, 1977, pp. 340-363.

Mills, J. S. *A System of Logic*. New York: Longmans, Green and Co., 1925 (originally published in 1842).

Mintzberg, H. *The Nature of Managerial Work*. New York: Harper and Row, 1973.

Mitroff, I. I., and Mason, R. O. "Structuring Ill-Structured Policy Issues: Further Explorations in a Methodology for Messy Problems." *Strategic Management Journal*, Volume 1, 1980, pp 331-342.

Montgomery, I., and Benbasat, I. "Cost/Benefit Analysis of Computer Based Message System." *MIS Quarterly*, March 1983, pp. 1-13.

Nass, C., and Mason, L. "On the Study of Technology and Task: A Variable-Based Approach." In J. Fulk and C. Steinfield (eds.), *Organizations and Communication Technology*, Newbury Park, California: Sage Publications, 1990, pp. 46-67.

O'Reilly, C. A. "Variations in Decision Makers' Use of Information Sources: The Impact of Quality and Accessibility of Information." *Academy of Management Journal*, Volume 25, no. 4, 1982, pp. 756-771.

O'Reilly, C. A., and Pondy, L. R. "Organizational Communication." In S. Kerr (Ed.), *Organizational Behavior*, Columbus, Ohio: Grid, 1979.

Perrow, C. "A Framework for the Comparative Analysis of Organizations." *American Sociological Review*, April 1967, pp. 194-208.

Prietula, M., and Simon, H. A. "Experts in Your Midst." *Harvard Business Review*, January-February 1989, pp. 120-124.

Randolph, W. Organization Technology and the Media and Purpose Dimensions of Organization Communication." *Journal of Business Research*, Volume 6, August 1978, pp. 237-259.

Rice, R. E. "Computer-Mediated Communication and Organization Innovation." *Journal of Communication*, Volume 37, Autumn 1987, pp. 65-94.

Sherif, M., and Sherif, C. *Social Psychology*. New York: Harper and Row, 1969.

Silver, S. D.; Cohen, B. P.; and Rainwater, J. "Group Structure and Information Exchange in Innovative Problem Solving." In E. J. Lawler and B. Markowsky (eds.), *Advances in Group Processes*, Volume 5, Greenwich, Connecticut: JAI Press Inc., 1988.

Stefik, M.; Foster, G.; Bobrow, G.; Kahn, K.; Lanning, S.; and Suchman, L. "Beyond the Chalkboard: Computer Support for Collaboration and Problem Solving in Meetings." *Communications of the ACM*, Volume 30, January 1987, pp. 32-47.

Steinfield, C. W., and Fulk, J. "On the Role of Theory in Research on Information Technologies in Organizations." *Communication Research*, Volume 14, Number 5, 1987, pp. 479-490.

Stinchcombe, A. L. "Bureaucratic and Craft Administration of Production: A Comparative Study." *Administrative Science Quarterly*, Volume 4, 1959, pp. 168-187.

Tushman, M., and Nadler, D. "Information Processing as an Integrating Concept in Organization Design." *Academy of Management Review*, July 1978, pp. 613-624.

Tushman, M. L. "Subunit Characteristics and Subunit Communication Structure: A Contingency Analysis." *Administrative Science Quarterly*, Volume 24, 1979, pp. 82-97.

Van de Ven, A.; Delbecq, A.; and Koenig, R. "Determinants of Coordination Modes Within Organizations." *American Sociological Review*, Volume 41, April 1976, pp. 322-338.

Weick, K. *The Social Psychology of Organizing*, Second Edition. New York: Random House, 1979.

Zadeh, L. "Outline of a New Approach to the Analysis of Complex Systems and Decision Processes." *IEEE Transactions on Systems, Man, and Cybernetics*, Volume SMC-3, Number 1, 1973, pp. 28-44.

7. ENDNOTE

1. Hereafter, "efficiency" and "effectiveness" will be referred to as "effectiveness" with the latter expressed in an italicized form. In cases where the meaning of "efficiency" or "effectiveness" only is to be emphasized, the same will be used separately in a plain form.