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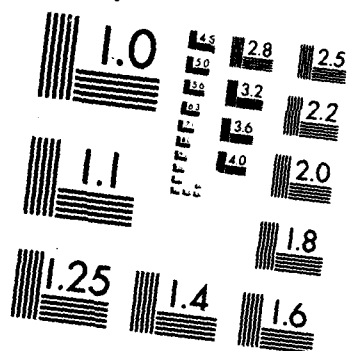
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# Organizations As Information Processing Systems

Office of Naval Research  
Technical Report Series

The Relationship Among Message  
Equivocality, Media Selection, and  
Manager Performance: Implications  
for Information Support Systems

Richard Daft  
Robert Lengel  
Linda Trevino

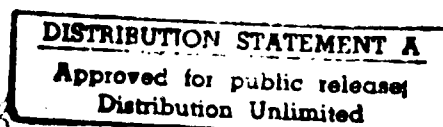
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Organizations as Information Processing Systems

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THE RELATIONSHIP AMONG MESSAGE EQUIVOCALITY, MEDIA SELECTION, AND  
MANAGER PERFORMANCE: IMPLICATIONS FOR INFORMATION SUPPORT SYSTEMS

Abstract

A field study of 95 middle-level and upper-level managers was undertaken to explain top managers' selection of communication media. The findings indicate that media vary in their capacity to convey information cues, and that media "richness" is correlated with message equivocality. Managers prefer rich media for equivocal communications and less rich media for unequivocal communications. The data suggest that high performing managers are more sensitive to the relationship between message equivocality and media richness than low performing managers. Implications for managers' use of information systems and electronic media are discussed.

**Keywords:** Communication media, Equivocality, Information processing,  
Managerial communication, Managerial performance, Media richness, Media  
selection, Uncertainty

## THE RELATIONSHIP AMONG MESSAGE EQUIVOCALITY, MEDIA SELECTION, AND MANAGER PERFORMANCE: IMPLICATIONS FOR INFORMATION SUPPORT SYSTEMS

Designers of management information systems and new electronic communication systems have been wrestling with a similar problem--the tendency for managers, especially senior managers, to not make full use of these systems. The literature suggests that successful information systems are used more readily in lower level operations than in support of top manager decision-making [34]. Executives spend a large proportion of their time communicating through traditional face-to-face and group discussions despite the existence of sophisticated communication modes such as teleconferencing, computer conferencing and electronic mail.

We propose that the problem confronting the use of these systems has a common cause--the nature of senior management work. The purpose of this paper is to present a theory that explains the relationship between the content of managerial communications and media selection. A model is proposed that can help determine when face-to-face or other communication media are appropriate. The research findings suggest that face-to-face communications have special ability to inform the types of decisions made by senior managers. Perhaps more important, the findings indicate that high performing managers have the ability to match communication media to the communication task at hand. High performing managers intuitively understand that face-to-face communication is needed for unstructured communications and written modes work best for more routine communications.

Recent Developments in Decision Support and Communication Systems  
Decision Support Systems (DSS) have been suggested as a possible solution to the problem of why management information systems (MIS) fail to support top

level management decision-making. Recognizing that top managers deal with novel problems and unstructured rather than structured decisions, the MIS literature suggests that DSS aim to support these unstructured decisions [16, 46, 34]. Sprague [46] defined the following characteristics of DSS: 1) aimed at unstructured problems; 2) use models or analytic techniques combined with traditional data access and retrieval; 3) are user friendly and interactive; and 4) emphasize flexibility and adaptability to change. The argument is that competent DSS professionals, working with managers, can change unstructured decisions and problems to structured ones by breaking the problem into subproblems and developing problem-solving models. Although this argument is attractive, other researchers recognize that DSS may not solve the problem. Martin and Powers [30] employed a critical success factor approach to develop a description of executives' information needs. He determined that much of the information needed by executives was both subjective and qualitative, and therefore difficult to provide through formal MIS. Robey and Taggart [40] argued that computers can effectively model analytical left brain functions. But, it is unlikely that right brain activities such as intuition can be successfully modeled by computer systems. Harris and Brightman [17] reported that the lack of completely specified goals makes it difficult to model the cognitive tasks of managers who have unstructured work profiles.

Alavi [27], after conducting in-depth interviews with executives regarding their decision support needs, concluded that DSS must be capable of handling complexity, uncertainty reduction, and conflict resolution. Executives reported that their decision-making difficulties involved 1) conflicting objectives and criteria; 2) the need to make decisions without sufficient information; 3) high complexity; 4) problems of estimating impact; 5) time pressure; 6) lack of clear, measurable objectives; 7) determining what

information is relevant; and 8) communicating with the people involved. In addition, Sprague [46] suggested that because many top level decisions are made in groups, DSS must support "interdependent" decisions, not simply the decisions of a single executive at a computer terminal.

A related problem involves managers' use of communications technology, sometimes called the "new media" [38]. Traditional communication channels such as memos, telephone, and face-to-face have the potential to be supplemented with or replaced by electronic messaging, video displays, and teleconferencing. Initially the need for face-to-face communications was expected to diminish as new media took over, contributing to managerial efficiency and effectiveness. Workers were expected to stay at home and be linked to the office by electronic media [10]. Teleconferencing was predicted to reduce managerial travel, and to decentralize decision-making [27]. However, these expectations have not been met. Executives continue to prefer oral, face-to-face communication for much of their work. Distributed environments have not occurred as quickly as some experts had imagined [27]. Computer terminals are used to allow employees to work extra hours at home, not to move the workplace to the home. The availability of teleconferencing and other electronic media have not reduced travel or face-to-face communications [22]. Trauth, Kwan, and Barber [50] suggested that a major challenge for future research in this area is to discover factors that influence the successful incorporation and acceptance of new communication technologies in organizations.

### Theory Development

#### Background and assumptions

Our approach to the study of why managers process information as they do is

based on several assumptions. The most basic assumption is that organizations are, above all, human interaction systems. Information is conveyed through symbols and language systems that are used to interpret situations and adjust behavior. Information is exchanged to accomplish internal tasks, to coordinate diverse activities, and to interpret the environment. Information acquires meaning and value as it is processed and transferred along formal and informal organizational networks.

Second, human social systems are extraordinarily complex, far more complex than lower level machine or biological systems [3, 36]. Many issues are fuzzy and ill-defined. Although many situations can be considered patterned and orderly, others are ambiguous and unstructured. For these situations, alternatives cannot be identified, data cannot be obtained or objectively evaluated, and outcomes are unpredictable [4, 52]. A distinguishing feature of human social systems is the presence of ambiguity. To survive, organizations must develop information processing mechanisms capable of coping with ambiguous, unstructured problems.

Third, organizational information processing goes beyond what an individual does [18, 8]. A distinguishing feature of organizational information processing is sharing. Organization members develop a shared system of meaning. Typically, information processing and decision making at the organization level involves several interdependent managers who converge on a similar interpretation and agree on a decision. Because decisions are frequently made by coalitions, information processing at the organizational level must bridge disagreement and diversity, a process quite distinct from the cognitive processing of an isolated individual.

### Uncertainty and equivocality

To understand the nature of organizational information processing, it is necessary to disentangle basic causes of information processing in organizations. Research in organizational theory and organizational communication suggests there are two influences on information processing, the traditional concept of uncertainty and a more recent idea called equivocality.

**Uncertainty:** Traditionally, information processing has been conceptualized in terms of its role in reducing uncertainty. Uncertainty has come to mean the absence of information [31, 45, 15]. In a narrow sense, as information increases, uncertainty decreases. Galbraith [14] defined uncertainty as "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization."

Organizations that face high uncertainty acquire information, perhaps through data bases or decision support systems, to decrease that uncertainty and solve problems. In a situation of uncertainty, managers are able to ask questions and obtain answers. The organization can be structured to help managers reduce uncertainty through management information systems, periodic reports, rules and procedures, or group meetings. The response to uncertainty is to find answers through the acquisition and analysis of data.

**Equivocality:** In contrast, the concept of equivocality means ambiguity, the existence of multiple and conflicting interpretations about an organizational situation [52, 7]. Equivocality often means confusion, disagreement and lack of understanding. Managers are not certain what questions to ask, and if questions are posed there is no store of objective data to provide an answer. Managers may have to spend time thinking about what to do, search beyond current data bases, or rely upon accumulated experience and judgment. For

example, Mintzberg, Raisinghani and Theoret [33], examined twenty-five organizational decisions. In most cases, they did not find textbook "uncertainty" where alternatives could be defined and information obtained. Instead, they found decision-making under ambiguity. Little data were available. Managers had to interpret the situation from vague cues and negotiate a solution.

Equivocality will be high when managers' frames of reference differ or when the topic is ambiguous. A manufacturing manager may have a difficult time understanding the perspective of a management information specialist. An ambiguous problem may be perceived differently by managers from different functional departments. Emotion-laden messages often are personal and subjective, and therefore open to misinterpretation. In these cases, a common perspective does not exist and shared meaning must be established before mutual understanding can occur.

A major difference between uncertainty and equivocality is in the information processing response of managers. Uncertainty leads to the acquisition of data. However, when confronted with an equivocal issue, managers must develop a common grammar to interpret the event. Equivocality leads to the exchange of subjective views among managers to define the problem and resolve disagreements. The organizational response is to enact a solution rather than to find a solution in external data [6, 8]. The organization reduces equivocality by pooling opinions and overcoming disagreement. This leads to a shared understanding and social agreement about the correct response. The response to equivocality comes from within the management group in the form of defining what events mean and enacting a solution.

We propose that equivocality is the barrier confronting management information

systems and new media. Equivocal situations are novel and nonrecurring. Equivocal situations require hunches, discussion and social support. Management information support systems are based on the assumption of what we have defined as uncertainty; a belief that problems can be defined, decomposed, and solved through objective analysis. Equivocality is an information problem that is difficult to resolve with technology and data bases. In this study we propose that media available to managers vary in their capacity to handle equivocality. Various media available to managers will be explored to understand the role of media in equivocality reduction.

#### Media channels

The next question is, "How can information processing accommodate equivocality?" Communication media available to managers (e.g., memos, telephone, computer printout, face-to-face) are expected to differ in their ability to facilitate understanding when events are equivocal. Media can be characterized as high or low in "richness" based on their capacity to facilitate shared meaning [5, 48]. A rich medium facilitates insight and rapid understanding. Media typically available to managers are organized in a hierarchy in Figure 1. The Figure 1 hierarchy ranks media channels in terms of their capacity for processing equivocal information and incorporates four media classifications: (1) face-to-face, (2) telephone, (3) addressed documents, and (4) unaddressed documents.

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Insert Figure 1 about here  
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The richness of each medium is based upon a blend of four criteria:

1. Feedback. Instant feedback allows questions to be asked and corrections to be made.
2. Multiple cues. An array of cues may be part of the message, including physical presence, voice inflection, high context, body gestures, words, numbers, and graphic symbols. Rutter and Stephenson [44] found a critical difference in media to be the number of social cues available. They also found media could be characterized by their overall "cuelessness."
3. Language variety. Language variety is the range of meaning that can be conveyed with language symbols. Numbers convey greater precision of meaning than does natural language. Natural language can be used to convey understanding of a broader set of concepts and ideas [9].
4. Personal focus. A message will be conveyed more fully when personal feelings and emotions infuse the communication. Some messages can be tailored to the frame of reference, needs, and current situation of the receiver.

Face-to-face is considered the richest communication medium. Face-to-face communication allows rapid mutual feedback. A message can be adjusted, clarified, and reinterpreted instantly. Other forms of communication, such as memos, do not allow for timely adjustments and refocusing of the message. Feedback is essential to resolve an issue that is ambiguous or in dispute [52, 26]. Laboratory research on group decision-making has shown that large initial differences of opinion readily converge into a shared position via face-to-face compared to computer mediated communication [24]. Face-to-face also allows the simultaneous communication of multiple cues. Head nods, smiles, eye contact, tone of voice, and other nonverbal behavior can be used to regulate, modify, and control the communication exchange. Face-to-face communication also uses high variety natural language. Face-to-face communication also is personal and conveys emotion.

The telephone medium is somewhat less rich than face-to-face. Feedback capability is fast, but visual cues and body language are filtered out. Individuals rely on language content and audio cues such as tone of voice to convey messages and reach understanding. The telephone medium is personal and uses natural language which makes it relatively high in richness capacity.

Addressed written communications such as letters, notes and memos are lower still in media richness. Feedback is slow. Only written information is conveyed, so voice cues are absent and visual cues are limited to those on paper. A few additional cues can be communicated through choice of stationery, and the formality of language. Addressed documents can be tailored to the individual recipient and personalized. For example, a personal note can be written at the bottom of a formal letter. Thus written communications are more personal and somewhat richer than standard documents or bulletins.

Formal, unaddressed documents are lowest in richness. Examples are fliers, bulletins and standard quantitative reports. These communications often utilize numbers that are useful in communicating quantifiable information, but do not have the information carrying capacity of natural language [9]. Fliers and bulletins fall in this category because they communicate simple, objective information to a wide audience. They are not focused toward any individual.

#### The equivocality/richness match

The point of this theoretical discussion is that for effective communication to occur, the richness of the medium should match the equivocality of message content. When the communication concerns well-defined issues and information, equivocality is low. Precise written or quantified data can be communicated

through media low on the richness hierarchy. On the other hand, highly equivocal messages demand rich media, such as face-to-face, to facilitate understanding and the emergence of a common perspective and understanding.

The proposed relationship between media richness and message equivocality is illustrated in Figure 2. Communications along the Figure 2 diagonal would reflect a match between medium and message. The medium would have sufficient capacity to enable sender and receiver to attain mutual understanding. An equivocality/richness mismatch may explain communication and decision-making failures. Standard computer reports applied to equivocal problems will not accommodate the subjective nature of these problems. The data oversimplify the problem and crucial cues may be lost. Moreover, face-to-face media may not be suited to objective, well-understood problems. Face-to-face discussion may contain unnecessary, surplus meaning. Multiple cues can overcomplicate the communication and distract the receiver's attention from the routine message.

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### Hypotheses

The discussion above has argued that the concept of equivocality influences communication processes in organizations. We have proposed that problems of ambiguity, subjectivity, and different frames of reference cannot be resolved simply by analyzing objective data. Managers respond to equivocal events by discussing the problem among themselves, defining or enacting a solution, and by acquiring social support. Equivocal communications cannot be handled by the same procedures used to reduce "uncertainty" because data are not

available and problems are not analyzable. Managers thus will use face-to-face communications when equivocality is high.

The basic proposition to be tested is that organizational information processing is characterized by a positive relationship between equivocality as defined above and the richness of the medium selected. This relationship is in the following hypothesis.

Hypothesis 1: Managerial information processing will be characterized by a positive relationship between message equivocality and media richness.

As an auxiliary hypothesis, we propose that equivocality explains the apparent preference for oral versus written media described by Mintzberg [32] and others [28, 21, 19, 23]. A large portion of managerial work may be spent coping with equivocal situations, which would explain the preference for oral media. However, when equivocality is low, managers are expected to prefer written media.

Hypothesis 2: Managers will select oral media for communication episodes high in equivocality and written media for communication episodes low in equivocality.

Finally, we propose that these relationships will hold more strongly for high performing managers. Managers spend eighty percent of their time communicating [32]. Communication effectiveness and hence managerial effectiveness may be related to whether media are selected to fit messages. Difficult, equivocal messages should be handled through the face-to-face medium. However, managers would find it efficient to use written media when messages are straightforward and convey objective data. If the logic of the

relationship between equivocality and media richness is correct, then managers who select the appropriate medium for the message are expected to be rated as high performing.

Hypothesis 3: Managers who are sensitive to the relationship between equivocality and media richness are more likely to be rated as high performers.

#### Research Method

Data to test the above hypotheses were collected as part of a larger study of patterns of media use in a large petrochemical company. In a pilot study, lengthy interviews were conducted with a convenience sample of general managers. The interviews were structured around the Critical Success Factor (CSF) technique [42, 41]. Managers were asked to identify key areas of responsibility and performance, called CSFs. The CSF provided a concrete referent in the manager's experience about which the interviewer could identify information needs and the communication activities associated with meeting those needs. The goal was to learn about communication incidents and media used by managers. One outcome of the pilot study was identification of a list of communication media typically used by managers.

The second step was to develop a sample of communication incidents based on actual managerial work. Based on additional interviews, over 200 incidents of managerial communications were recorded. The interview procedure asked managers to describe recent incidents in which they used various media. This is the critical incident technique developed by Rosenbloom and Wolik [43] and subsequently employed by Dewhurst [11]. After eliminating repetition and overlap, 60 incidents representative of managerial communications were selected for the final data collection.

The equivocality of each incident was rated by 30 judges. The panel was composed of 17 management faculty members and 13 practicing managers. The concept of equivocality, including ambiguous content and different frames of reference, was explained to each judge and a written definition was provided. The average equivocality rating for the judges was then computed for each incident. Example incidents and the judges' ratings are as follows: (1 = low equivocality, 5 = high equivocality).

1. To give your immediate subordinate a set of five cost figures that he requested last week. (equivocality = 1.74)
2. To let a new worker know that he is doing an excellent job and that you are pleased. (equivocality = 2.16)
3. To explain to your new secretary how you want your phone calls handled. (equivocality = 2.41)
4. To persuade one of your peers to stay with your firm and to turn down an attractive job with another firm. (equivocality = 3.44)
5. To get an explanation from a peer in another department of a complicated technical matter in which you have little formal training or experience. (equivocality = 4.25)

For the next step of the study, a sample of 95 managers in the petrochemical company was asked to select the medium of communication they would use for each of the 60 incidents. Media included letters, face-to-face, fliers, memos, telephone, and public address systems. These managers did not have access to "new media," so these media were not included in the questionnaire. The 95 respondents had not participated in earlier parts of the research. Respondents were given instructions for completing the instruments, and they were requested to indicate which of ten media they would use to send or

receive each message. Media in addition to the six of interest were included to disguise the underlying model. An example of how each incident was presented in the questionnaire is below.

You are faced with the following communication tasks. Select the medium you would use in each case by marking "X" in the appropriate box.

The purpose of the Communication Task is:

1. To give your immediate subordinate a set of five cost figures that he requested last week.

|        |                         |                                 |                   |                       |           |
|--------|-------------------------|---------------------------------|-------------------|-----------------------|-----------|
| Letter | Face-to-Face or Meeting | Flier/Bulletin                  | Formal Memorandum | Single Purpose Report | Telephone |
| Note   | Public Address System   | Standardized Document or Report | Telex/Telegram    | Other                 |           |

Responses from these questions provided the data base to test whether media of higher richness were selected for equivocal communications.

Management performance: The petrochemical company maintained an extensive and sophisticated performance evaluation system for management personnel [12].

The company's performance evaluation system distributed manager performance ratings from high to low on a normal curve. The company could not provide performance data on all 95 managers because of the time required for this task. However, the personnel director agreed to provide data on 30 managers. These data were provided following the initial analysis of the relationship between media richness and equivocality. The media selection pattern for each manager was analyzed. The 15 managers who displayed the largest correlations between media richness and message equivocality were assigned to a "media sensitive" group. The 15 managers showing the weakest correlations between media richness and message equivocality were assigned to a "media insensitive" group. Media insensitive managers selected media almost randomly without regard to message content. These 30 managers provided a blind experiment

because managers were assigned to the two groups without any knowledge of their performance. Any difference in performance ratings would be based solely on how managers matched media to message equivocality.

**Data analysis:** For analysis purposes, media were grouped into four categories: face-to-face, telephone, addressed documents, and unaddressed documents. Communication incidents also were grouped into four categories representing low to high equivocality. The four categories are parallel to the four media classifications and enable the data to be presented in tabular form.

### Results

Hypothesis 1 predicted a positive relationship between media richness and message equivocality. The data pertaining to this hypothesis are shown in Table 1. As equivocality increases, the percentage of respondents preferring richer media also increases. For communications rated low in equivocality, only 13.5 percent of the respondents preferred the face-to-face medium. This percentage increases to 84.1 percent when equivocality is high. By contrast, 62.4 percent of the respondents preferred a written, addressed medium for messages low in equivocality, but only 10.8 percent selected this medium for communications high in equivocality. A Chi-Square test ( $p < .001$ ) between equivocality and media selection indicates support for Hypothesis 1. The findings suggest that rich media are preferred for communications high in equivocality, where ambiguity and different frames of reference are involved. Media low in richness are preferred for communications that are unequivocal--the content is clear and participants have similar frames of reference.

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Insert Table 1 about here  
-----

The media were combined into written and oral categories to test Hypothesis 2. These data are illustrated in Figure 3. Figure 3 provides visual support for the relationship between media richness and equivocality. For low equivocality communication episodes, only 32.1 percent of respondents preferred oral media. Managers selected written media the majority of the time (67.9 percent) when equivocality was low. The preference for oral media increased to 88.7 percent for high equivocality communication episodes. These data provide empirical support for the hypothesis that oral media are preferred when it is difficult to achieve understanding between managers. When understanding is easier to achieve managers prefer written media. The fit between equivocality and media disagrees with the observation that managers prefer oral communication for sending and receiving all messages [32]. The Figure 3 findings suggest that managers don't prefer oral media for all communications, but that managers select media depending upon the nature of the communication. Both oral and written media are selected, depending on the message.

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Insert Figure 3 about here  
-----

Hypothesis 3 proposed that media selection would be related to manager performance. Correct media selection is expected to be related to communication effectiveness, and hence to manager performance. The 15 managers in the media sensitive group were compared to the 15 managers in the

media insensitive group. Table 2 summarizes the findings. In the media sensitive group, 13 of the 15 managers were rated as high performers on the internal corporate rating scale. In the media insensitive group, only 7 of the 15 were considered high performers. A Chi-Square test of the relationship between media selection pattern and performance indicates support for Hypothesis 3. Explaining differences in manager performance has typically been a difficult research problem [51]. The pattern in Table 2 suggests that media selection patterns of executives may be a component of performance, perhaps because high performing managers know how to communicate effectively.

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Insert Table 2 about here  
-----

#### Discussion and Implications

A puzzlement in the research literature concerns the failure of senior managers to make full use of management information systems and new communication media. The purpose of this paper was to address this concern by introducing the concept of equivocality and studying whether it helps explain managerial communication behavior. Managers often must communicate about ambiguous, novel problems that cannot be easily quantified, and for which data are not available. Each manager may have a different opinion or perspective on an equivocal issue. To solve problems characterized by equivocality, managers must enact an interpretation through interaction with others. Face-to-face communication provides the multiple cues, rapid feedback, and social support needed to reduce equivocality. The findings supported the theory that equivocal messages are communicated through richer media.

However, the findings do not suggest that managers always prefer rich media.

Managers are under time pressure to be efficient information processors. The findings suggest that a manager's job contains a mix of routine and nonroutine elements. The managers in our study selected media both low and high in richness. Indeed, they displayed a preference for notes, memos, and standard documents for communications low in equivocality. Managers rated as high performers were sensitive to the different media requirements.

Although the research did not incorporate new media, the findings help explain why managers appear to not fully utilize information systems and electronic media. The assumption that all management problems can be broken down and solved with technology may be incorrect. Equivocal issues can be approached from multiple perspectives, choices may be unclear, disagreement may exist, and it may not even be possible to identify the exact managers influenced by the problem. Moreover, the assumption that written media or electronic substitutes can replace face-to-face communications is not correct for many management communications. While the face-to-face medium is weak and inefficient for processing data or resolving objective problems, it is a powerful medium for transferring multiple cues, enabling rapid feedback among several managers, and attaining social support for enacting solutions to equivocal problems.

Since media characteristics determine their capacity to facilitate manager understanding, the application of new media can perhaps be tailored to match richness capacity to management's information needs. For example, Steinfield and Fulk [48] proposed that videoconferencing is somewhat less rich than face-to-face, but has greater information capacity than the telephone. Videoconferencing has full video and audio capabilities, and feedback is fast. Some cues such as body language and nonverbal messages are restricted. The

important regulating features of mutual gaze are filtered out [1, 49].

Teleconferences have also been found to be less emotional in tone than face-to-face communications [53]. Dutton, Fulk, and Steinfield [13] suggest that teleconferences are better suited to the exchange of explicit information than to emotional conflict, bargaining, and negotiation.

Electronic mail has characteristics similar to telephone or written memos [48]. Electronic mail has the capacity for rapid feedback and it can quickly reach a large, geographically dispersed audience. Computer messaging systems have been found to be appropriate for exchanging discrete information and staying in touch. However, many cues, such as eye contact, voice and body language are filtered out. Electronic mail is considered inappropriate for exchanging confidential information, resolving disagreements, getting to know someone, or negotiating [47, 39].

Additional research will be required to determine if the relationship between equivocality and media richness requirements holds in settings where new media are implemented. One way to increase utilization is for designers to support management's need for multiple cues, discussion, and social consensus rather than try to force managers into media not appropriate to their needs. The strength of traditional MIS is the ability to provide rapid and inexpensive data. Newer developments, based upon an understanding of equivocality, will help managers deal with unstructured, ambiguous problems. For example, Huber [20] suggests the Group Decision Support System (GDSS) as a way to apply new media to highly equivocal situations. This system provides face-to-face discussion and access to data bases. This system provides personal CRTs for each participant in a group meeting along with a public display screen visible to all group members. Each member has the capacity to think and work

individually with software and extant data bases, while exchanging ideas with others through verbal discussions and a public display screen. Feedback among members is fast, and social support can be obtained. Data to handle explicit questions are provided by the computer terminal available to each participant. This information design is ideal for decision situations that are complex, require data formulations and reformulations, but also require equivocality reduction and social support.

An important problem for future research is to develop methods of analysis that will determine which aspects of managerial communication and decision-making are amenable to technological support and which are not. This approach should not assume that all management problems are objective and can be decomposed and supported by hard data. For example, Decision Support System (DSS) designers help managers define their jobs more objectively, structure and formalize the procedures they employ, and segregate those aspects of the decision process that can be automated [29]. However, highly equivocal aspects of managerial work cannot and should not be defined objectively. The subtle messages, such as whether R&D managers are truly committed to a new technology, or whether other executives will likely support a course of action, are not easily transmitted through media other than face-to-face.

In conclusion, the research in this paper has attempted to explore why managers select a medium for communication. Organizations contain a mix of information requirements. The well-defined coexists with the ambiguous, the routine with the nonroutine. Communication situations may have high or low equivocality and require media of varying degrees of richness. Media low in richness are appropriate for the efficient communication of objective data to support routine decisions. Rich media are used for the resolution of

subjective issues that involve divergent perspectives. The important point is that organizations require a number of information approaches. Electronic media can be evaluated and applied with respect to their richness capacity, and new forms of electronic media may be discovered that further increase capacity. Application of the right medium to the situation is the key. For senior managers, the information system should have the flexibility to accommodate information from both formal and informal systems and to utilize both rich and non-rich media.

## References

- [1] Argyle, M. and Cook, M. Gaze and Mutual Gaze. Cambridge University Press, Cambridge, 1975.
- [2] Alavi, M. "An Assessment of the Concept of Decision Support Systems as Viewed by Senior-Level Executives," MIS Quarterly, December 1982, pp. 1-9.
- [3] Boulding, K. "General Systems Theory: The Skeleton of Science," Management Science, Volume 2, 1956, pp. 197-207.
- [4] Cohen, M. D., March, J. G. and Olsen, J. P. "A Garbage Can Model of Organizational Choice," Administrative Science Quarterly, Volume 17, 1972, pp. 1-25.
- [5] Daft, R. L. and Lengel, R. H. "Information Richness: A New Approach to Managerial Information Processing and Organization Design," in B. Staw and L. Cummings, (eds.), Research in Organizational Behavior, JAI Press, Greenwich, Connecticut, 1984.
- [6] Daft, R. L. and Lengel, R. H. "A Proposed Integration Among Organizational Information Requirements, Media Richness, and Structural Design," Management Science, 1986, pp. 191-233.
- [7] Daft, R. L. and Macintosh, N. B. "A Tentative Exploration into the Amount and Equivocality of Information Processing in Organizational Work Units," Administrative Science Quarterly, Volume 26, 1981, pp. 207-224.
- [8] Daft, R. L. and Weick, K. E. "Toward a Model of Organizations as Interpretation Systems," Academy of Management Review, Volume 9, 1984, pp. 284-295.
- [9] Daft, R. L. and Wiginton, J. C. "Language and Organizations," Academy of Management Review, Volume 4, Number 2, 1979, pp. 179-191.
- [10] Deal, T. E. and Kennedy, A. A. Corporate Cultures, Addison-Wesley, Reading, Massachusetts, 1982.
- [11] Dewhirst, H. D. "Influence of Perceived Information Sharing Norms on Communication Channel Utilization," Academy of Management Journal, Volume 14, 1971, pp. 305-315.
- [12] Dreher, G. F. "Predicting the Salary Satisfaction of Exempt Employees," Personnel Psychology, Volume 34, 1981, pp. 579-589.
- [13] Dutton, W. H., Fulk, J. and Steinfield, C. "Utilization of Video Conferencing," Telecommunications Policy, September 1982, pp. 164-178.
- [14] Galbraith, J. Strategies of Organizational Design, Addison-Wesley, Reading, Massachusetts, 1973.

- [15] Garner, W. R. Uncertainty and Structure as Psychological Concepts, Wiley, New York, 1962.
- [16] Gorry, G. A. and Morton, M. S. "A Framework for Management Information Systems," Sloan Management Review, Volume 13, Number 1, 1971, pp. 55-70.
- [17] Harris, S. E. and Brightman, H. J. "Design Implications of a Task-Driven Approach to Unstructured Cognitive Tasks in Office Work," ACM Transactions on an Office Information Systems, Volume 3, Number 3, 1985, pp. 292-306.
- [18] Hedberg, B. "How Organizations Learn and Unlearn," in D. Nystrom and W. Starbuck, (eds.), Handbook of Organizational Design, Oxford University Press, New York, 1981, pp. 11-27.
- [19] Higgins, J. C. and Finn, R. "The Chief Executive and His Information Systems," Omega, Volume 5, 1977, pp. 557-566.
- [20] Huber, G. P. "Issues in the Design of Group Decision Support Systems," MIS Quarterly, September 1984, pp. 195-204.
- [21] Huber, G. P. "Organizational Information Systems: Determinants of Their Performance and Behavior," Management Science, Volume 28, 1982, pp. 138-155.
- [22] Johansen, R. and Bullen, C. "What to Expect from Teleconferencing," Harvard Business Review, March-April 1984, pp. 164-174.
- [23] Jones, J. W. and McLeod, R. Jr. "The Structure of Executive Information Systems: An Exploratory Analysis," Decision Science, Volume 17, 1986, pp. 220-249.
- [24] Kiesler, S., Siegel, J. and McGuire, T. W. "Social Psychological Aspects of Computer-Mediated Communication," American Psychologist, October 1984, pp. 1123-1134.
- [25] Kotter, J. P. Power and Influence; Beyond Formal Authority, Free Press, New York, 1985.
- [26] Kreps, G. L. "A Field Experimental Test and Reevaluation of Weick's Model of Organizing," Communication Yearbook 4, 1980, pp. 389-398.
- [27] Kriebel, C. H. and Strong, D. M. "A Survey of the MIS and Telecommunications Activities of Major Business Firms," MIS Quarterly, September 1984, pp. 171-177.
- [28] Mackenzie, K. D. "Organizational Structure as the Primal Information System: An Interpretation," Management of Office Information System, in S. K. Chang, (ed.), Plenum Publishing Corp., New York, 1984, pp. 27-46.
- [29] Mann, R. I. and Watson, H. J. "A Contingency Model for User Involvement in DSS Development," MIS Quarterly, Volume 8, Number 1, March 1984, pp.

- [30] Martin, J. and Powers, M. E. "Truth or Corporate Propaganda: The Value of a Good War Story," in L. Pondy, P. Frost, G. Morgan, and T. Dandridge, (eds.), Organizational Symbolism, JAI Press, Greenwich, Connecticut, 1980, pp. 93-108.
- [31] Miller, G. A. and Frick, F. C. "Statistical Behaviorists and Sequences of Responses," Psychological Review, Volume 56, 1949, pp. 311-324.
- [32] Mintzberg, H. The Nature of Managerial Work, Harper & Row, New York, 1973.
- [33] Mintzberg, H., Duru, R. and Theoret, A. "The Structure of 'Unstructured' Decision Processes," Administrative Science Quarterly, Volume 21, 1976, pp. 246-275.
- [34] Munro, M. C. and Wheeler, B. R. "Planning Critical Success Factors, and Management's Information Requirements," MIS Quarterly, December 1980, pp. 27-38.
- [35] Picot, A., Klingenberg, H. and Kronzle, H. "Office Technology: A Report on Attitudes and Channel Selection from Field Studies in Germany," Communication Yearbook 6, 1982.
- [36] Pondy, L. and Mitroff, I. "Beyond Open Systems Models of Organizations," in B. M. Staw, (ed.), Research in Organizational Behavior, JAI Press, Greenwich, Connecticut, 1979, pp. 3-39.
- [37] Rice, R. E. "The Impacts of Computer-Mediated Organizational and Interpersonal Communication," in M. Williams, (ed.), Annual Review of Information Science and Technology, Knowledge Industry Pubs., White Plains, New York, Volume 15, 1980.
- [38] Rice, R. E. The New Media: Communication, Research, and Technology, Sage Publications, Beverly Hills, 1984.
- [39] Rice, R. E. and Case, D. "Electronic Message Systems in the University: A Description of Use and Utility," Journal of Communication, Volume 33, Number 1, 1983, pp. 131-152.
- [40] Robey, D. and Taggart, W. "Human Information Processing in Information and Decision Support Systems," MIS Quarterly, June 1982, pp. 61-73.
- [41] Rockhart, J. F. "The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective," Sloan Management Review, Volume 24, Number 1, 1982.
- [42] Rockhart, J. F. "Chief Executives Define Their Own Data Needs," Harvard Business Review, Volume 72, 1979, pp. 81-93.
- [43] Rosenbloom, R. and Wolik, F. Technology and Information Transfer: A Survey of Practice in Industrial Organizations, Harvard University, Graduate School of Business Administration, Boston, 1970.

- [44] Rutter, D. R. and Stephenson, G. M. "The Role of Visual Communication in Social Interaction," Current Anthropology, Volume 20, Number 1, 1979, pp. 124-125.
- [45] Shannon, C. and Weaver, W. The Mathematical Theory of Communication, University of Illinois Press, Urbana, Illinois, 1949.
- [46] Sprague, R. H. "A Framework for the Development of Decision Support Systems," MIS Quarterly, December 1980, pp. 1-26.
- [47] Steinfield, C. W. "Dimensions of Electronic Mail Use in an Organizational Setting," in R. B. Robinson and J. A. Pearce, (eds.), Academy of Management Proceedings 1985, 45th Annual Meeting, San Diego, California, 1985.
- [48] Steinfield, C. W. and Fulk, J. "Task Demands and Managers' Use of Communication Media," Unpublished Manuscript, University of Southern California, 1985.
- [49] Strickland, L. H., Guild, P., Barefoot, J. C. and Paterson, S. A. "Teleconferencing and Leadership Emergence," Human Relations, Volume 31, Number 7, 1978, pp. 583-596.
- [50] Trauth, E., Kwan, S. K. and Barber, S. "Channel Selection and Effective Communication for Managerial Decision Making," ACM Transactions on Office Information Systems, Volume 2, Number 2, 1984, pp. 123-140.
- [51] Vicino, F. L. and Bass, B. M. "Lifespace Variables and Managerial Success," Journal of Applied Psychology, Volume 63, 1978, pp. 81-88.
- [52] Weick, K. "The Social Psychology of Organizing," Addison-Wesley, Reading, Massachusetts, 1979.
- [53] Williams, E. "Teleconferencing: Social and Psychological Factors," Journal of Communication, Summer 1978, pp. 125-131.

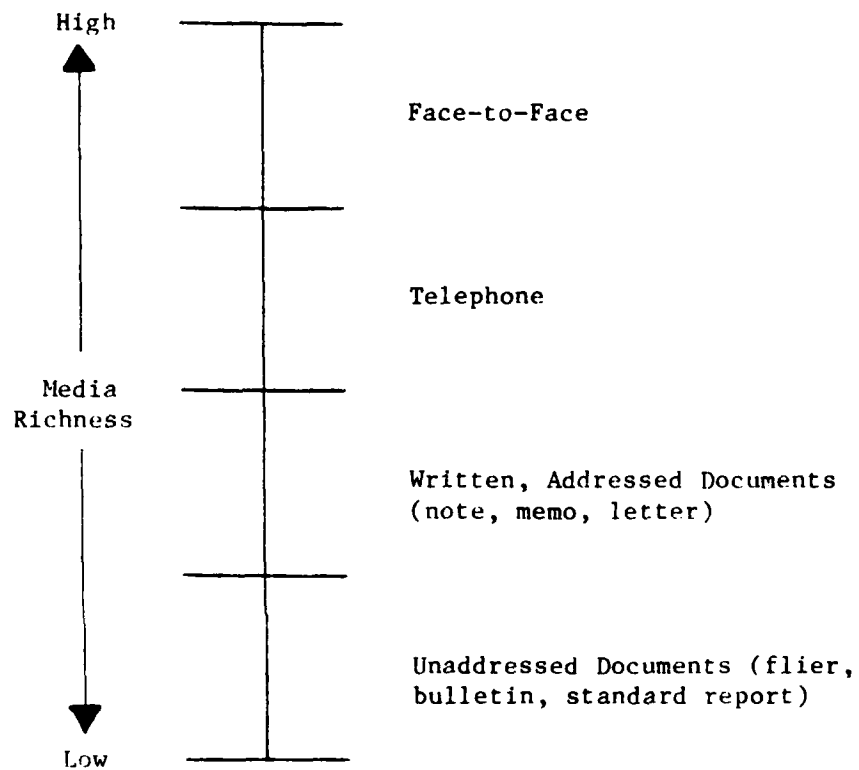


Figure 1. Hierarchy of Media Richness.

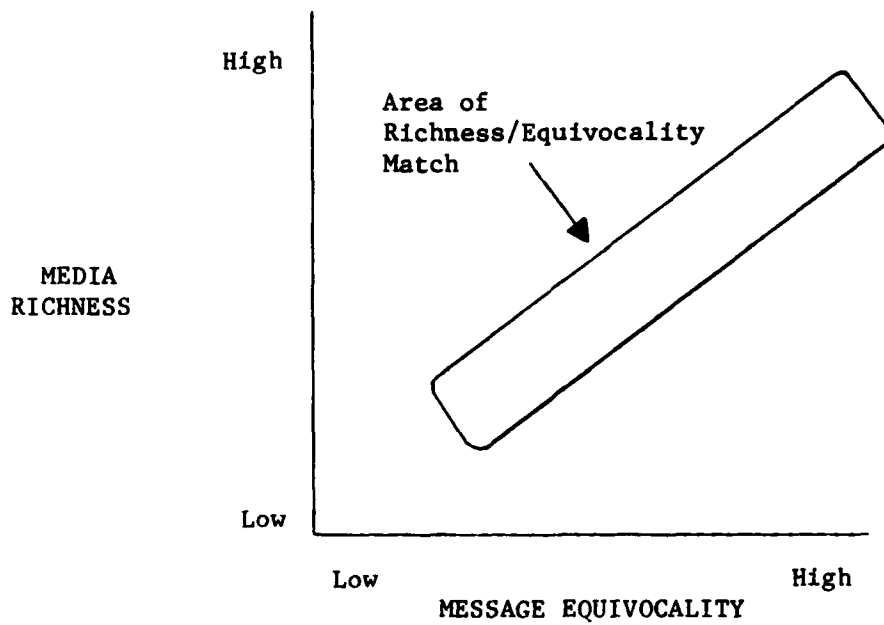


Figure 2. Relationship Between Media Richness and Message Equivocality for Effective Communications.

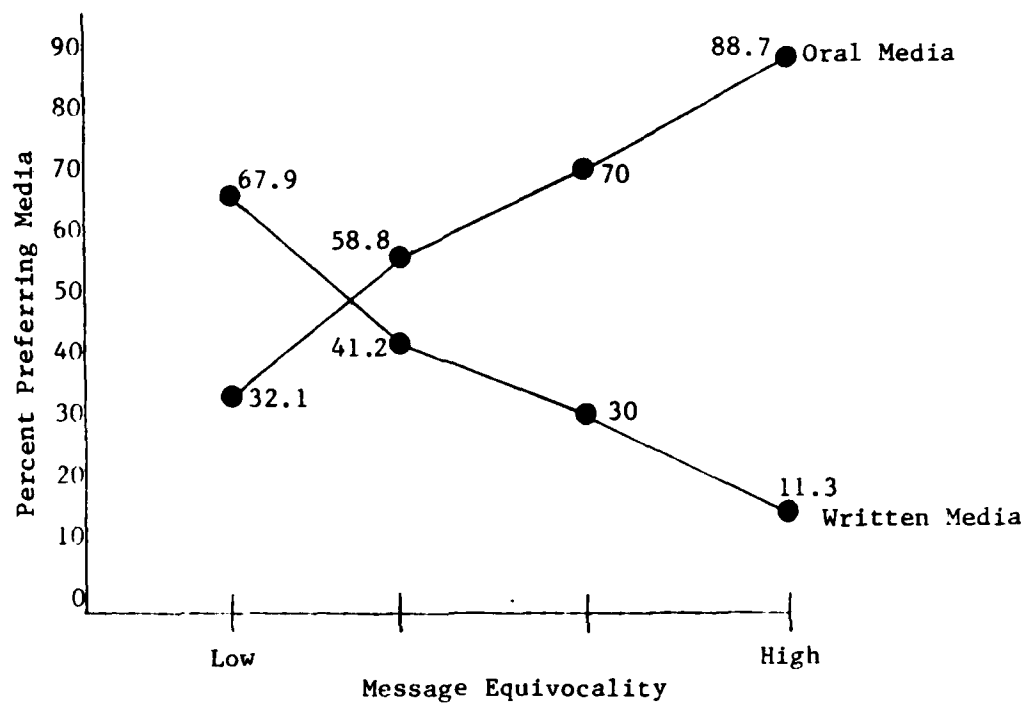


Figure 3. Message Equivocality and Oral versus Written Media Preferences.

Table 1. Relationship Between Message Equivocality and Media Richness.

| Communication Medium  | <div> <div>Low</div> <div>← Message Equivocality →</div> <div>High</div> </div> |        |                               |        |                               |        |                                  |       |
|-----------------------|---------------------------------------------------------------------------------|--------|-------------------------------|--------|-------------------------------|--------|----------------------------------|-------|
|                       | <sup>a</sup><br>$1 \leq E \leq 2$<br>percent (N)                                |        | $2 < E \leq 3$<br>percent (N) |        | $3 < E \leq 4$<br>percent (N) |        | $4 \geq E \leq 5$<br>percent (N) |       |
| Face-to-Face          | 13.5                                                                            | (148)  | 40.5                          | (598)  | 60.6                          | (1342) | 84.1                             | (546) |
| Telephone             | 18.6                                                                            | (203)  | 18.3                          | (271)  | 9.4                           | (208)  | 4.6                              | (30)  |
| Addressed Documents   | 62.4                                                                            | (683)  | 40.5                          | (598)  | 28.4                          | (628)  | 10.8                             | (70)  |
| Unaddressed Documents | 5.5                                                                             | (60)   | 0.7                           | (11)   | 1.7                           | (37)   | 0.5                              | (3)   |
|                       | 100                                                                             | (1098) | 100                           | (1478) | 100                           | (2215) | 100                              | (649) |

<sup>a</sup>E = equivocality

Chi-Square = 1099.13; p = .001

Table 2. Relationships Between Media Selection and Performance Ratings for 30 Managers.

| Performance     | Media Insensitive Managers |            | Media Sensitive Managers |            |
|-----------------|----------------------------|------------|--------------------------|------------|
|                 | <u>%</u>                   | <u>No.</u> | <u>%</u>                 | <u>No.</u> |
| High Performing | 47                         | (7)        | 87                       | (13)       |
| Low Performing  | 53                         | (8)        | 13                       | (2)        |
| Total           | 100                        | (15)       | 100                      | (15)       |

Chi-Square = 5.4; p = .02

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