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RELATIONSHIPS OF JOB CATEGORIES AND ORGANIZATIONAL LEVELS TO USE OF COMMUNICATION CHANNELS, INCLUDING ELECTRONIC MAIL: A META-ANALYSIS AND EXTENSION*

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ABSTRACT

This study tests hypotheses derived from information processing theory concerning relationships between individuals' job category, organizational level, and levels and patterns of media usage. Media studied include face-to-face, meetings, memos/letters, telephone and electronic mail. In the meta-analysis of over 40 studies, usage of different media was significantly different for managers/executives versus others, and was highly correlated with organizational level. In the individual-level analyses of four organizations, the majority of respondents were classified into their actual job categories, and according to distances between organizational levels, by a discriminant function involving only relative extent of media use, especially participation in meetings. Contrary to information richness theory, upper-level respondents (managers) did not necessarily use electronic mail less than did lower-level respondents (clerical workers). The article concludes by discussing implications for theories of organizational media use and implementation of electronic mail systems.

INTRODUCTION

Many authors have argued that communication is the basis of intra-organizational behaviour. Thus, understanding how and why different media are used in organizations should contribute to both organizational theory and practice. There has been a tendency to rely on Mintzberg's (1973) observations of just 5 managers as one of the empirical bases for assertions about how managers and others use different communication channels as part of their everyday activities.

Comparative data on media use in other job categories or organizations is often overlooked in spite of a wide range of studies (as reviewed by Panko (1984) and Rice and Associates (1984, ch. 8)). And many of these other empirical studies

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are primarily descriptive, rather than empirical tests of theories that could explain differential usage of media across job categories or organizational levels. Further, most studies of organizational media use treat each communication channel in isolation, rather than identifying underlying patterns. Finally, relatively few empirical studies have considered how new organizational media, such as electronic mail, fit into these patterns of use (Rice and Case, 1983).

This article attempts to overcome these limitations by means of meta-analyses of over 40 prior studies, and individual-level analyses of four organizations. The general theoretical argument is that differences in job categories and organizational levels represent different information processing requirements. Specific media are more likely to satisfy these requirements than are other media, depending on the social presence or richness of information conveyed. Thus, individuals in different job categories and organizational levels will use different media in predictably different amounts and patterns. Figure 1 summarizes this argument, which is described in the following sections. The subsequent empirical results are used to suggest some new propositions about organizational media use, especially electronic mail.

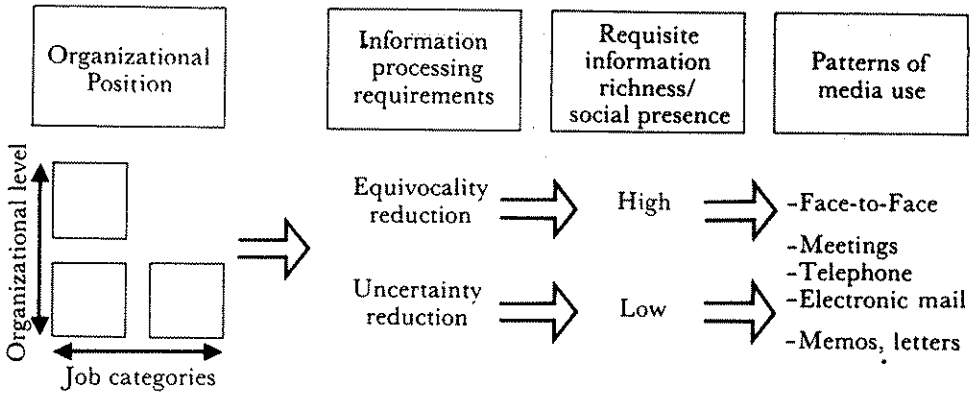

Figure 1. Visual model of theoretical argument motivating the meta-analysis and individual-level analyses

TWO INFLUENCES ON ORGANIZATIONAL MEDIA USE: TASK ENVIRONMENT AND MEDIA CHARACTERISTICS

Organizational information processing theory views organizations as social structures constituted to gather and interpret information about the environment and use it to convert other resources into outputs such as products and actions.

The theory proposes that organizations develop internal structures to match environmental demands and to satisfy their varying information processing needs (Burns and Stalker, 1961; Daft and Lengel, 1986; Galbraith, 1977; Lawrence and Lorsch, 1969; Perrow, 1967; Tushman and Nadler, 1978; Weick, 1979). Recent extensions of the theory propose that how internal organizational communication creates shared interpretations of information, and the concomitant use of communication media, is influenced by (1) characteristics of the environment; (2) the ways in which decisions are made and actions taken; (3) previous experience of the individuals involved; and (4) the methods used to acquire and process information (Daft and Weick, 1984). This article focuses on the first and last of these categories.[1]

Characteristics of the Environment

Information processing requirements. Differences in environments generate different information processing requirements as manifested in specific organizational tasks. At least two primary information processing requirements have been postulated: the reduction of uncertainty and the reduction of equivocality.

Uncertainty is the difference between the amount of information required to perform the task and the amount of information already possessed by the organization, an interaction between the task and the organization performing the task (Galbraith, 1977). Organizations may respond to uncertainty in a number of ways, such as processing additional information, decreasing the need for information processing through redesign, improving organizational co-ordination, or using new information systems. An example would be to discuss a printed report listing financial information from a computerized database as part of a decision-making process. '*Equivocality* is the extent to which data are unclear and suggest multiple interpretations about the environment. . . [it] is reduced through shared observations and discussion until a common grammar and course of action can be agreed on' (Daft and Weick, 1984, p. 291). An example would be getting to know a client and developing a trusting relationship before entering into negotiations about a novel venture.

Thus, differences in task environments represent different information processing requirements that may be differentially satisfied by different organizational media.

Job categories and organizational level. Galbraith (1977) argued that lateral connections within an organization attempt to co-ordinate interdependencies among tasks. Tushman and Nadler (1978) showed that communication within and across boundaries of subunits are significant aspects of organizational structure. If organizations develop technologies and structures in order to reduce environmental uncertainty and equivocality, then task environments are manifested in organizational structures in at least two primary ways: job categories – horizontal differentiation – and organizational hierarchy – vertical differentiation.

Job categories are organizational roles and positions occupied by individuals who perform similar activities, are socialized in similar ways, and are confronted with similar information processing requirements. Thus individuals in different job categories are likely to exhibit different levels of use of certain organizational media (Daft and Lengel, 1984).

Higher-level organizational activities involve institutional and managerial concerns such as strategy, planning and environmental scanning (Daft and Lengel, 1984, fig. 6). 'Upper managers bring together and interpret information for the system as a whole' (Daft and Weick, 1984, p. 285). Other research on upper-level job categories supports this notion of increased ambiguity, external orientation, policy-setting, and unpredictability (Alexander, 1979; Burns, 1957; Carlson, 1951; Hannaway, 1985; Kotter, 1982; Mintzberg, 1973; Pavett and Lau, 1983; Thomason, 1966, 1967). Hannaway (1985) found that upper-level managers reported significantly higher uncertainty in their tasks than did lower-level managers. Steinfield (1983) found that managers and professionals reported significantly lower analysability than did technicians, who in turn reported significantly lower levels than did clerical staff. He also found that managers and professionals reported significantly higher levels of uncertainty than did technicians and clerical workers.

Thus, higher organizational levels involve reducing equivocality. Lower-level job categories are more likely to involve operational and technical matters, tasks such as reducing uncertainty.

Methods Used to Acquire and Process Information: Communication Media and their Characteristics

Mediated communication, such as telephone calls, letters and memos, and electronic mail, differs from face-to-face communication in at least two major ways. (1) Different media can overcome various situational constraints such as time, location, permanence, distribution and distance. However, (2) media can transmit only certain portions of all the cues of human communication (Rice, 1987; Rice and Associates, 1984; Short *et al.*, 1976). The second characteristic has been summarized by two related concepts: social presence and information richness.

Social presence is the degree to which a communication medium conveys the physical presence and non-verbal and social cues of the participants (Short *et al.*, 1976). Social presence is a perceived attribute of a medium that is dependent upon particular communication contexts and characteristics of the medium. Short *et al.*, using individuals' responses to a social presence scale ranging from +0.9 to −0.9 (based upon semantic differential items), reported mean scale values of 0.81 for face-to-face communication, 0.24 for television, −0.18 for multispeaker audio, −0.52 for the telephone, and −0.85 for a business letter (1976, p. 71).** Among newer media, computer-mediated communication systems are consistently ranked as less appropriate for tasks requiring more social presence (see review in Rice, 1987). This lower social presence is partially attributed to the associated reduction in communication cues (Sproull and Kiesler, 1986). However, they have been shown to provide moderate levels of socio-emotional content (Rice and Love, 1987), and can overcome many situational constraints better than some other media.[2] Thus media that convey less social presence, such as a business letter, are less able to help reduce equivocality (such as in bargaining, negotiation, conflict resolution, *etc*). These same media, however, are more able to help reduce uncertainty (such as in exchanging facts or information, *etc*).

Based upon the early work of Bodensteiner (1970), Daft and Lengel (1984,

1986) have elaborated the concept of *information richness*, the extent to which media are able to bridge different frames of reference, make issues less ambiguous, provide immediate feedback, transmit multiple cues, involve several senses, transmit language variety, or provide opportunities for learning in a given time interval (Daft and Lengel, 1986, p. 560). These authors propose that media can be ranked on the basis of their information richness. Trevino *et al.*, (1987) found that face-to-face communication was ranked by managers as more likely to be chosen (46 per cent of 355 hypothetical communication incidents) for communication tasks involving ambiguity than telephone, written and electronic mail (all around 25 per cent). Electronic mail was more likely to be chosen (62 per cent) for tasks involving situational constraints than the other media (telephone 51 per cent, written 43 per cent and face-to-face 17 per cent). Other studies have found similar rankings of media on a variety of information richness scales (Fulk and Schmitz, 1988; Markus, 1988; Tsuneki, 1988; Zmud *et al.*, 1990).

Whereas Short *et al.* (1976) emphasize interactions of media for different tasks, and Rice and Case (1983) emphasize interactions between media use and job category, Daft and Lengel and others propose that low levels of information richness are sufficient for reducing uncertainty, but high levels are needed for reducing equivocality. However, Holland *et al.* (1976) found moderate correlations ($r = 0.34$) between uncertainty in important technical information and the use of communication channels with greater information richness.

Taking into account the consistent ranking of media along scales of both social presence and information richness, and the capabilities and attributes of new communication media, we extend the initial rankings of organizational communication channels to include electronic mail, as providing moderate levels of social presence or information richness (Rice and Case, 1983).

We also explicitly consider the distinction between less structured interpersonal communication, such as dyadic conversations, and more structured interpersonal communication, such as meetings.[3] Meetings may involve more social presence than dyadic conversation because of the availability of multiple views, multiple directions of interaction, and the greater challenges to achieving convergence upon a common interpretation (Daft and Weick, 1984; Rice, 1984). Meetings may have more information richness because they provide more opportunity for development of 'shared meanings, beliefs, and commitment to the organization' (Hannaway, 1987, p. 126). Kefalas and Schoderbek (1973) found that meetings were used more frequently by managers in dynamic environments than in stable ones. McLeod and Jones (1987, p. 100) found that 'the average value of information gained in scheduled meetings was the highest of all media at 7.4, followed by unscheduled meetings at 6.2'.

HYPOTHESES

The relationships discussed above lead to a general and a more specific directional hypothesis. It is difficult to separate the influences of job category and organizational level, because the latter is a special case of the former. Data and results from prior studies can often speak to the first but not to the second hypothesis.

H1: Different job categories will be characterized by different levels and patterns of use of different media.

H2: Higher-level job categories will be characterized by greater use of media with higher information richness or social presence (*i.e.*, face-to-face). Lower-level job categories will be characterized by greater use of media with lower information richness or social presence (*i.e.*, memos and letters).

DATA AND METHOD

Two sets of data will be separately described and used to test these hypotheses: a meta-analysis of quantitative studies of media use in organizations, and an individual-level analysis of media use in four organizations.

I: META-ANALYSIS

Table I summarizes the studies and the nature of their data used in the meta-analysis.

Sample Differences

The samples used in the studies are conceptually and operationally different in many ways, of course. Even when respondents' job categories are given, no standard categorization scheme is used, although a few studies use definitions derived from Burns (1954) or Mintzberg (1973).[4] The sample organizations also differ, and their descriptions receive the least attention in many of the studies.

The other major dimension of difference is the method of data collection. Surveys in these studies are generally one-time activities; observations typically consist of one or two days per respondent; diaries are typically one week in length; random buzzers are typically used one or a few days in a given week. Most studies using multiple data collection methods report good correspondences between observational data and self-report data on overall time spent communicating (Goetzinger and Valentine, 1962; Hinrichs, 1964; Klemmer and Snyder, 1972; Roberts and O'Reilly, 1974). However, several studies found that allocations to specific channels showed discrepancies.

Typically these involved overestimates of time spent reading, writing, phoning and thinking, and underestimates of time spent in face-to-face contact and meetings (Dahl and Lewis, 1975; Hinrichs, 1964; Kay and Meyer, 1962; Klemmer and Snyder, 1972; McCall *et al.*, 1978). An exception is the Talbot *et al.* (1982) data. Conrath *et al.* (1982) report severe under-reporting in diaries; although Conrath *et al.* (1983) report that diaries in three studies were more reliable than questionnaire data. The most comprehensive analysis of such comparisons, based upon an average of 603 observations of each of 36 office workers, as well as task identifications, task sorting, and time estimation, concluded that subjects can reliably identify which tasks they perform (92 per cent correct; $r = 0.8$), fairly well rank each task according to the time spent in each task ($r = 0.7$), and are not reliably able to estimate specific amounts of time

allocated to each task ($r = 0.3$; mean correct score for 13 respondents was 76 per cent) (Hartley *et al.*, 1977). McCall *et al.*, (1978) discuss the strengths and weaknesses of various methods for collecting data about managerial use of time and media.

Measurement

Only studies that measured media on the basis of percentage of total day's activities were analysed. Media use, subsamples and organizations, managerial job categories, and level within organizations, when provided, were coded. When separate percentages are reported, oral communication consists of telephone or face-to-face, while text communication consists of writing or reading; some studies report only total oral and/or total text figures. Different organizations within studies were coded separately to be able to take into account their separate influences. Studies and organizations may or may not include multiple subsamples.

To compare means for managers and executives with those of all other job categories, which are not very comparable across organizations, those subsamples were coded as 1, while the other subsamples were coded as 0. Organizational level is measured as the ordinal ranking of job categories, when obvious, with 1 as highest (for example, executives = 1, managers = 2, technical staff = 3, and secretaries = 4). The (sub)sample sizes reported in each study were used to compare weighted with unweighted results (if not reported, the weight was set to 1), to take into account the possible greater validity of results from large-sample studies. Table II summarizes these measures.

Method

Data from usable studies in table I (indicated by an asterisk) were analysed to provide unweighted and weighted study, job category, and organizational descriptive statistics by medium and for managers/executives versus others. Then a general linear model was used to partial out the effect of data collection method from the effect of occupying a managerial/executive versus another job category. Finally, the subsample's organizational level was correlated with percentage of media use, for each category of medium, within different organizations.

Results

Job Category. Table II shows, for unweighted and weighted analyses, respectively, the following average percentage use of various media: face-to-face (38 per cent, 30 per cent), telephone (12 per cent, 14 per cent), total oral (51 per cent, 43 per cent); reading (12 per cent, 10 per cent), writing (18 per cent, 14 per cent) and total text (30 per cent, 31 per cent). Studies with larger sample sizes seem to find slightly higher levels of media use. Based upon data from approximately 80 samples in nearly 40 studies of intra-organizational media use, from 73 per cent to 81 per cent of the day is spent communicating, with face-to-face the most frequent channel. Managers/executives reported higher usage of face-to-face (unweighted, 48 per cent, weighted, 37 per cent) and lower total text (21 per cent, 23 per cent) than did the whole sample. These results provide support for H1.

Table III shows the results of the joint linear model. The method of data collection was a significant source of variation for face-to-face, total oral, writing

Table I. Mean percentage allocation of working day to communication channels for various job categories and organizational levels

	Communication activities			
	Oral		*Textual*	
Source, sample, method	*FTF*	*Phone*	*Read*	*Write*
Bair (1984)*				
$N = 691$ (7 organizations) (SR)	32	13	20	
immediate workgroup	48		38	
in same building	17		24	
different locations, same company	13		22	
external to company	22		14	
Booz, Allen, Hamilton, in Panko and Sprague (1982); Poppel (1982)*				
$N = 300$; 90,000 time samples (OBS)	26	20	8	13
Brewer and Tomlinson (1964)*				
$N = 6$ managers (DI)	51	6	13	13
Burns (1954, 1957)*				
$N = 76$ managers (DI)				
7 firms overall:	52		24	
increasing in manufacturing	42		29	
susceptibility	44		35	
to external	55		28	
change, from	68		22	
manufacturing	56		20	
branch to	71		20	
technical R&D technical R&D	80		12	
Case Inst. (1958)*				
$N = 1500$ chemists (MULT)	40		29	
Clendening, *et al.* (1981)				
$N = 30$ managers, professionals (SR)	42	36	22	
Conrath (1973)				
$N = 115$ managers, 4086 events (EV)	66	13	21	
Conrath and Bair (1974)				
$N = 39$ 'knowledge workers' (OBS, EV)		Terminal		
1051 events, extra-org.	59	26	4	10
1354 events, intra-org.	75	9	13	3
Coulter and Hayo (1978)*	62	18	15	
top managers (DI) dictation	5		in office: 7	
meetings:			at home: 8	
scheduled	15			
unscheduled	11			
out of office	24			
interruptions	7			
Cox (1976)*				
$N = 150$ business graduates (SR)	55		20	25
listening	29	memoes	32	
speaking	26	letters	29	
		short reports	26	
		long reports	13	

Table I. (*Contd*)

	Communication activities			
	Oral		*Textual*	
Source, sample, method	*FTF*	*Phone*	*Read*	*Write*
Croston and Goulding (1967)*				
$N = 7$ managers (OBS)	56	7	18	
Dahl and Lewis (1975)*				
$N = 12$ middle–high admin				
(DI by BUZZ 30 times/day)	47	9	?	
(6855 OBS in 5 weeks)	69	4	?	
Dubin and Spray (1964)*				
$N = 8$ managers (DI)	55	6	5	
Francas and Larimer (no date)				
$N = 14$ management and secretaries (MULT)				
pre-Email (percent of interactions)	57	36	7	
post-Email (" ")	40	19	Email = 33 4	
Goetzinger and Valentine (1962)				
$N = 40$ faculty and staff (DI)	40	37	11	12
Hanika (1963) (UNK)*				
estimated	49		32	
actual	54		25	
Hannaway (1987)*				
$N = 50$ managers one other	10	5	9	
(DI by BUZZ 30 times/day) meetings	46			
Hinrichs (1964)*				
(DI, BUZZ):				
$N = 58$ supervisors	49	8	10	14
$N = 20$ technical	27	6	11	16
$N = 232$ non-supervisory (DI)	16–46	9–11	30–39	
to middle management (OBS)	22–54	6–8	24–29	
Horne and Lupton (1965)*				
$N = 66$ managers (DI)	54	9	10	14
Ives and Olson (1981)*				
$N = 6$ managers (OBS)	68	10	?	
Jones and McLeod (1986)				
Jones *et al.* (1986)				
$N = 5$ managers (DI, EV)	17	21	62	
meetings: scheduled	5	addressed: memo	19	
unscheduled	6	letter	20	
other: tours, meals, social	6	unaddressed: periodical	10	
		computer report	3	
		non-computer report	9	
upper managers meetings	11	14 addressed	37	
other	10	unaddressed	28	
middle managers meetings	7	29 addressed	42	
other	8	unaddressed	14	
lower managers meetings	9	19 addressed	22	
other	30	unaddressed	20	

Table I. (*Contd*)

	Communication activities			
	Oral		*Textual*	
Source, sample, method	*FTF*	*Phone*	*Read*	*Write*
Kefalas and Schoderbek (1973)				
$N = 89$ (SR)	67		33	
meetings	37			
Kelley (1964)*				
$N = 4$ managers (OBS)	61	?	?	
Klemmer and Snyder (1972)*				
scientists and engineers				
$N = 3132$ (OBS, EV)	35	7	12	14[a]
$N = 2626$ (SR, EV)	20	8	20	22[a]
Klingenberg and Kranzle (1983) (SR)*				
Fornfeist (1985) (DI, EV)				
$N = 363$ in industrial firm				
scheduled	11	12	21	
unscheduled	15			
$N = 86$ in insurance firm				
scheduled	17	13	30	
unscheduled	17			
for 1249 events in industrial firm:				
$N = 33$ accounting	20	11	17	
$N = 84$ R&D	26	8	18	
$N = 79$ DP management	27	9	17	
$N = 39$ production	32	12	32	
$N = 82$ sales	25	12	20	
$N = 19$ purchasing for				
UNK events in insurance firm:	20	16	20	
$N = 26$ DP management	32	9	37	
$N = 15$ real estate	32	12	34	
$N = 35$ insurance workers	31	16	26	
Knopf (1982)*				
$N = 1200$, 11 companies (MULT)				
top managers	53	16	27	
managers	47	9	27	
knowledge worker	23	17	42	
secretary	0	20	55	
Kurke and Aldrich (1983)*				
$N = 4$ managers (OBS)	62	8	26	
Lawler *et al.* (1968)*				
$N = 4390$ diary forms (DI, EV)				
$N = 34$ middle, 71 lower managers				
50 in manufacturing plant				
meetings	33	14	letters	6
individual	40		records	5
55 in 4 social services				
meetings	14	28	letters	8
individual	41		records	10

Table I. (*Contd*)

	Communication activities					
	Oral		*Textual*			
Source, sample, method	*FTF*	*Phone*	*Read*		*Write*	
Lowenstein (1979);* Engel *et al.* (1980)					T[c]	
$N = 396$ managers[d] (SR)	27	16	11	18[b]	11	?
$N = 1074$ managers	14	12	7	21	16	4
$N = 297$ managers[e]	14	4	10	19	11	10
$N = 1066$ managers[d]	27	10	11	18	12	?
$N = 363$ secretaries[f]	5	9	4	40	3	29
Mattox (1984)*						
$N = 2$ top managers (OBS)	74	9		8		
$N = 10$ division heads	40	16		17		
$N = 12$ support staff	23	20		40		
secretaries (OBS)	4	24		72		
(SR)	20	26		40		
Mintzberg (1973)*						
$N = 5$ managers (OBS)	69	6		20		
Nolting (1942)*						
$N = 21$ city managers (DI)						
meetings	33	22[g]		17		
interviewing	4					
Palmer and Beishon (1970)*						
$N = 1$ manager (AUD)	54	6		15		
Panko and Sprague (1982)* Ganz and Peacock (1981)						
$N = 17{,}000$ (UNK)[h]	18	5		47		
Roberts and O'Reilly (1976)*						
$N = 52$ managers (SR)	51	22		24		
Roth (1963)*						
research lab (OBS)						
supervisors	53	9	15		16	
senior researcher	60	7	10		16	
chemists, engineers	28	7	9		21	
Ruchinskas (1982)*						
$N = 162$ engineers (SR)	23	13		40		
$N = 124$ operations	29	16		31		
$N = 125$ technicals	26	11		37		
$N = 114$ financial	25	18		37		
$N = 147$ corporate	27	18		40		
Snyder and Glueck (1980)*						
$N = 2$ managers (OBS) meetings:		6		23		
evening	7					
scheduled	40					
unscheduled	18					
tours	13					
Sproull (1984)*						
$N = 7$ managers in meetings:						
7 organizations scheduled	33	12				
unscheduled	34					

Table I. (*Contd*)

	Communication activities					
	Oral			Textual		
Source, sample, method	*FTF*	*Phone*		*Read*		*Write*
Steinfield (1981)*						
$N = 357$ supervisors (SR)						
receiving	78	3			6	
transmitting	59	4			14	
Steinfield (1983)*						
Users of Email (SR)			Email		Paper	Computer
$N = 40$ upper/middle management	28	12	10	14	6	12
$N = 141$ professional	18	6	10	17	5	22
$N = 13$ technician	14	6	12	12	9	19
$N = 14$ clerical	12	15	12	6	15	27
Non-users of Email						
$N = 35$ upper/middle management	31	14		12	18	3
$N = 77$ professional	19	13		14	15	8
$N = 29$ technician	10	12		13	16	13
$N = 18$ clerical	11	21		12	23	18
Stewart (1971)*						
$N = 160$ managers (SR)	44	6			36	
Talbott *et al.* (1982)*						
$N = 20$ managers (OBS) meetings	34					
other	25	7		4		8
(SR) meetings	28					
other	13	5		9		16
Teger (1983)*						
$N = 5300$ (SR)						
executives	53	18			27	
managers	47	9			29	
professionals	25	17			42	
secretaries	0	20			55	
Thomason (1966)*						
4 sites (DI), $N = 21^{i}$ arranged by hierarchies:						
1. Project manager		81			12	
Operations manager		82			18	
Plant manager (with technical problems)		32			18	
Plant manager		62			29	
Assistant		37			51	
2. Managing director		31			21	
Technical director		61			21	
Technical manager		63			20	
4 technicians		30			24	
3. Managing director		58			36	
Sales manager		70			30	
Assistant		47			51	
4. Senior technologist		81			15	
5 technologists		39			46	

Table I. (*Contd*)

	Communication activities			
	Oral		*Textual*	
Source, sample, method	*FTF*	*Phone*	*Read*	*Write*
Volard and Davies (1982)*				
$N = 101$ (DI)	61	6	21	
W. H. (1949)*				
$N = 12$ directors (UNK)[j]				
conversations	45	5	25	5
dictate, give instructions	20			

Note

* = organizations used in analyses reported in tables II and III.

Data collection methods are abbreviated as follows:

AUD = audio tape
BUZZ = self report initiated by buzzer at random times
DI = respondent diary
EV = percentage of interaction events, not percentage of time
MULT = multiple methods
OBS = researcher observation
SR = respondent self report
UNK = unknown

[a] Data analysis and programming included.
[b] Includes searching, filing, dictating, proofing, copying, record-keeping, mail-handling.
[c] Use of terminal, or typing.
[d] Organization was meeting oriented.
[e] Used interactive computing.
[f] From same organization as $N = 1066$ managers; other three secretarial samples included in articles.
[g] 2 hours (22 per cent of 9-hour day) was devoted to 'talking with citizens in offices and phone', so this percentage overreports actual phone usage.
[h] Same organization as in Steinfield (1983); note similarly low face-to-face (FTF) figures.
[i] Diaries were kept for a week; except for 2nd organization, where figures represent average of two separate weeks. Other sites reported in article, but consist of one or two unidentified individuals each.
[j] These percentages, even though they add to 100 per cent (see discussion below), represent all the activities in an average 10-hour day.

Communication, of course, is only some of what individuals do in organizations. Some of these studies include or report these other activities, including 'travel', 'interpretation', 'thinking', 'research and administration' and 'other', but those percentages are not listed here. Some do not report these other activities but still report communication activities as a percentage of all activities. Thus percentages in these two kinds of reports do not total to 100 per cent. Some studies, however, report only the relative distribution of communication activities, or are based only on a total number of communication events, so those percentages add up to 100 per cent. Clearly, such values cannot be compared to those of the former studies.

Table II. Mean percentage of day spent using various communication channels, and correlation with organizational level, for three units of analysis (study, managers, and organizations), and two sampling assumptions (weighted by size or not), from reviewed studies

Communication channel, sample		*N*	*Descriptive statistics* *XM*	*s*	*Corr. w/ Level*	*N*
Face-to-face						
sample:	unweighted	66	38.0	20.8	−0.74**	22
	weighted		29.5	266.8	−0.84**	
organizations:	unweighted	35	45.4	17.9		
	weighted		32 7	167.6		
managers:	unweighted	33	48.2	18.7		
	weighted		37.5	247.5		
Telephone						
sample:	unweighted	66	11.8	6.2	0.51*	22
	weighted		13.7	71.5	0.56*	
organizations:	unweighted	35	10.9	6.3		
	weighted		13.1	57.1		
managers:	unweighted	34	10.9	6.3		
	weighted		11.8	70.7		
Total oral						
sample:	unweighted	85	51.4	19.3	−0.61**	36
	weighted		43.3	225.6	−0.75**	
organizations:	unweighted	40	56.9	16.2		
	weighted		45.2	148.4		
managers:	unweighted	44	60.8	17.7		
	weighted		49.6	229.5		
Reading						
sample:	unweighted	27	11.8	4.7	−0.26	10
	weighted		9.7	45.2	−0.23	
organizations:	unweighted	12	12.8	5.4		
	weighted		10.0	44.9		
managers:	unweighted	10	11.6	5.5		
	weighted		9.5	40.4		
Writing						
sample:	unweighted	27	18.3	9.4	0.79**	10
	weighted		13.9	74.6	0.35	
organizations:	unweighted	12	15.4	5.8		
	weighted		14.2	55.9		
managers:	unweighted	10	13.1	4.8		
	weighted		13.4	44.4		
Total text						
sample:	unweighted	81	29.6	13.5	0.76**	36
	weighted		30.9	168.9	0.90**	
organizations:	unweighted	37	25.7	10.0		
	weighted		28.3	123.2		
managers:	unweighted	40	21.3	8.2		
	weighted		22.8	82.4		

* $p<0.01$; ** $p<0.001$, one-tailed test.

N indicates the number of studies or samples used in each analysis; 'weighted' analyses are weighted according to the total number of individuals reported in the sample or subsample of the original study, shown in table I. In some studies only total oral and/or total text were reported. Thus, percentage of total oral or total text do not equal the sum of the separate percentages.

Table III. Linear models showing explanatory influence of data-collection method and managerial job category on percentage of time spent using various communication channels, from reviewed studies

Independent variables	*Dependent variables*					
	Oral				*Text*	
	Face	*Phone*	*Total*	*Read*	*Write*	*Total*
Method						
Observation	50.9%[a]	10.5[a]	61.9[a]	9.7[a]	14.7[a]	23.7[a]
Diary	45.9[a]	11.6[a]	57.8[a]	11.0[a]	14.3[a]	23.7[a]
Multiple methods	30.8[b]	15.5[a]	45.0[b]	—	—	36.0[b]
Self-report	26.5[b]	12.8[a]	40.1[b]	12.0[a]	21.6[a]	35.4[b]
F-ratio for step	9.7**	0.9	10.2**	0.8	9.3*	7.1**
Manager	47.5%[a]	11.3	60.6[a]	10.1	14.0	21.2[a]
F-ratio for step	15.4**	0.4	20.1**	2.2	2.7	34.0**
Overall						
D.F.	(62,4)	(62,4)	(81,4)	(25,3)	(25,3)	(77,4)
F-ratio	11.1	0.8	12.7	1.2	4.9	13.8
R^2	0.43**	0.05	0.40**	0.14	0.40*	0.43**

General linear models procedure, unbalanced designs, from statistical analysis system. Percentages are mean usage for each medium, by method, and by managers.
[ab] Means that are significantly different for different methods have different letters. For managers, [a] indicates that the mean is significantly different than the mean for all other job categories.
* $p<0.01$; ** $p<0.001$.

and total text. Total use of oral channels is significantly higher for observation (63 per cent) and diary (58 per cent) methods than for multiple methods (40 per cent) and self-report (45 per cent) method, while total use of text is significantly higher for multiple (36 per cent) and self-report (35 per cent) methods. Once these methodological influences were statistically controlled, the difference in media use between managerial/executive and other job categories was still significant for percentage usage of face-to-face (48 per cent), total oral (61 per cent) and total text (21 per cent). Overall, approximately 40 per cent of the variance in percentage media use, except for telephone and reading, was explained by just two variables: data collection method and manager/other job category. These results provide support for H1.

Organizational level. Table II shows that correlations between organizational level (1 = highest) and percentage use of communication channels were statistically significant for face-to-face (unweighted $r = -0.74$; weighted $r = -0.84$), telephone ($r = 0.51$; $r = 0.56$), total oral ($r = -0.61$; $r = -0.75$), writing ($r = 0.79$; n.s.) and total text ($r = 0.76$; $r = 0.90$). These results provide support for H2. There is no significant correlation between time spent reading and organizational level; individuals in all job categories spent about 10 per cent of their day reading. Note, however, that the results for telephone use, though never explicitly predicted in the literature, are perhaps counter-intuitive: the telephone is used more by individuals lower in the sampled organization.

This meta-analysis of nearly 40 studies considerably expands the basis for

claims about how managers and others spend their time communicating, over the few small-sample studies commonly referenced (*e.g.*, Mintzberg, 1973). Further, given the wide variation in samples, methods, and measures, these results indicate considerable validity of the overall means and correlations. Finally, the major differences remain even when these sources of variation are controlled.

II: INDIVIDUAL-LEVEL ANALYSIS IN FOUR ORGANIZATIONS[5]

Samples

The first site (DEF) was a large aerospace organization that performed contract research of the Defense Department. In keeping with its close interaction with military institutions, and because of the rigorous production standards required to satisfy the government contracts, the organization had a hierarchical culture. The site was approximately nine months into the process of implementing an integrated office system that at the time was used primarily for electronic mail. The sample of respondents consisted of 148 persons: a census of 73 users who had received training on the system, and a random sample of 75 users who had not received training. No significant differences between the two groups were detected. A 90 per cent response rate and some unclassifiable job categories resulted in a final sample size of 120.

The second site (R&D) was a non-profit contract research and development organization with approximately 900 employees. Most people worked on changing sets of projects that would each involve different sets of people in different disciplines and job categories, so the communication structure was necessarily integrated in a fluid, project-oriented matrix structure and thus low in hierarchy. The company had been using a new, internally-developed UNIX-based electronic mail system for approximately a year in the context of a general policy that encouraged and supported communication internally and externally. Two other systems had been in use for several years, so most users had considerable experience with electronic mail. Indeed, top managers received special terminals and accounts that made use of electronic mail particularly easy and functional. All 780 holders of computer accounts received a questionnaire; 508 returned it for a response rate of 65 per cent. Of these, only those 284 individuals who responded to the questionnaire *and* who had used electronic mail are included in the analysis.

The third site (GOV) was a small, decentralized federal agency office in charge of providing services and supplies to other agencies. GOV's 86 employees were all civil servants working in a clearly defined formalized hierarchy. Most were white-collar professionals, although some were clerical workers. A questionnaire was administered to all employees nine months after implementation of a local area network linking personal computers and providing electronic mail services. Based upon earlier success and satisfaction with an office minicomputer, upper management introduced electronic mail with the goal of improving professionals' productivity. Sixty-seven of 86 employees (78 per cent) responded.

The fourth site (MUN) was the municipal government of a mid-sized affluent West Coast city. Although job categories were explicitly hierarchical *within* the two sub-organizations (city managers and police), the two sub-organizations

responded to different and multiple constituencies, indicating two dimensions to this hierarchy. The city council and senior city officials supported the implementation of an electronic mail system, and the city manager and key departmental heads received their terminals first. Questionnaires were administered to all 159 municipal office system users approximately two years after the system was first implemented; 128 (81 per cent) responded.

Measurement

Table IV summarizes the operationalization and statistics of the measures.

Computer-monitored data. Reviews of computer-monitored measures of system use may be found in Ettema, 1985; Rice, 1982, 1990; Rice and Borgman, 1983; Rice and Shook, 1988; Sproull, 1986; Williams *et al.*, 1988. From the DEF data,

Table IV. Descriptive statistics, by organization

Variables	*Organizations*							
	DEF		*R&D*		*GOV*		*MUN*	
	M	*s*	*M*	*s*	*M*	*s*	*M*	*s*
Reported media usage[a]								
Read/write reports	17.5	18.7	13.8	17.4	11.8	16.9	—	—
Read/write letters/memos[b]	12.7	10.7	11.3	12.0	13.3	12.4	23.9	13.8
Using telephone	14.7	13.2	11.0	11.0	17.8	17.3	13.7	11.0
Face-to-face (not meetings)	19.3	13.7	15.5	11.5	15.2	11.6	17.2	11.5
Meetings	15.1	14.8	8.4	8.8	5.8	6.1	11.7	11.5
Email	4.5	6.7	6.5	6.0	7.7	11.9	9.4	10.0
Reported no. of messages sent	—	—	—	—	—	—	4.5	5.2
N	122		284		65		128	
Computer monitored usage[c]								
Log-ons per day using Email	1.9	2.6	—	—	—	—	—	—
Minutes per day using Email	57.8	99.6	—	—	—	—	—	—
Messages sent per day[d]	—	—	0.42	0.89	—	—	26.1	32.0
N	133		222		0		128	

Sample size of job categories for each organization

DEF	*N*	*R&D*	*N*	*GOV*	*N*	*MUN*	*N*
Manager	23	Execs/Top mngr	11				
Engineer	40	Senior manager	18	Execs/Mngr	12	Manager	29
Business	13	Administration	27	Supervisor	4	Staff-prof	40
Admin	13	Researcher	121	Staff-prof/tech	35	Police	34
Secretary	28	Technical staff	45				
Other[e]	12	Clerical	18	Clerical	10	Clerical	20

[a] The question stem for all measures of media use, except number of messages sent (for MUN), was 'In a typical day at work, what percentage of the time do you spend. . .'. Other activities were provided, such as 'Not communicating', and the questionnaire indicated that the separate percentages should total 100 per cent.

[b] For MUN, total of all writing (by hand or typing) and all reading.

[c] Values were normalized by procedure Rank of Statistical Analysis System for use in analyses, but non-normalized values shown here for clarity of interpretation.

[d] For MUN, not divided by days because two-week period equal for all users.

[e] For DEF, the residual job category of 'others' ($n = 12$) was excluded from all analyses involving job category. Business included finance and contracts.

the total number of minutes and log-ons were divided by the number of business days since first log-on and normalized (using the SAS Rank procedure) for analysis with parametric statistics. From the R&D data, the total number of messages sent by the account holder over a total of five four-week periods was divided by the number of days since first log-on, and normalized. From the MUN data, the total number of messages sent by each individual during the two-week period that bracketed the administration of questionnaires was used. Because this period was short and equal for all users, the total usage was not divided by the number of days, although it was normalized. Computer-monitored data were not available for the GOV sample.

Questionnaires.[6] Job categories were used as general indicators of differences in task environment, and were named as provided by the organizational contacts or the personnel department. They were ordered from high to low organizational level according to personnel classifications (R&D and GOV) or based upon our qualitative assessment (DEF & MUN). These rankings must be considered suggestive, although the upper and lower job categories in all cases are clearly hierarchically ordered; the most conservative interpretation of the results would consider only comparisons between, say, managers, staff, and secretaries.

Self-report items asked respondents to estimate the percentage of the day spent using a variety of specific communication channels as well as 'other' communication and 'non-communication' activities. Due to space limitations the correlation matrices are not shown (but are available from the authors), but overall, there is little correlation among use of communication channels, except among different measures of electronic mail usage (for the four organizations, $r = 0.17$, n.s. to 0.86, $p < 0.005$) and tendencies for the use of reports to be negatively correlated with face-to-face communication ($r = -0.11$, n.s. to -0.31, $p < 0.005$).

Method

Job categories. One-way analysis of variance was used to test for statistically significant differences of mean media usage across job categories for each of the four organizations. Then canonical discriminant analysis was used to identify patterns of media use that significantly differentiate job categories. Canonical discriminant analysis identifies independent variates consisting of weighted media use scores that best explain the variation in membership in the job categories. The adequacy of the discriminant classification of respondents into job categories was tested in three ways:

(1) the significance of the overall univariate Wilk's Lambda of the discriminant results;
(2) the percentage of correct classification compared to that expected by chance (*e.g.*, 1 divided by the number of job categories); and
(3) the correlation of the matrix of the number of individuals in their correct job category (where the value of cell (*ii*) has the number of individuals in job category *i*, [and zeros] elsewhere) with the matrix of the number of individuals classified into each job category by the discriminant analysis (where the value of cell (*ij*) is the number of individuals who actually belong to job category *i* but are classified into job category *j*).

Organizational level. Two analyses were performed to test whether overall patterns of media use (rather than usage of separate media) distinguish among organizational levels of these job categories. First, the ordering of job categories by organizational level was compared to the mean values of the discriminant functions. That is, if the discriminant function is primarily indicated by use of media with high social presence or information richness (face-to-face), then higher-level job categories should have a higher function mean. Second, the matrix of Mahalabonis distances between each job category as produced by the multiple discriminant functions was compared to the matrix of differences between organizational levels of each job category. The diagonal cells of the level matrix have a value of 0, and each off-diagonal cell (ij) has the number of levels between any two job categories i and j. For example, in R&D the number of levels between technical staff and administrators is two. The association between these two matrices was tested in two ways:

(1) the correlation of the vector of organizational level of the job categories with the vector of the mahalabonis distances; and
(2) the association between the two matrices, as calculated by quadratic assignment, a statistical technique for testing the similarity of two matrices with a parametric distribution of correlations of rows and columns for a given matrix size (Baker and Hubert, 1981).

RESULTS FROM INDIVIDUAL-LEVEL ANALYSIS IN FOUR ORGANIZATIONS

Job Category (H1)

Table V summarizes the extent to which differences in job category are associated with differences in mean media usage for the four organizations. Use of the communication channel conceptualized as high in social presence or information richness – meetings – was significantly associated with differences in job category in all four organizations. The variance explained by the meeting equations ranged from 25 per cent (GOV) to 63 per cent (DEF). The equation for telephone usage for DEF and R&D also showed strong differentiation ($R^2 = 17$ per cent and 30 per cent respectively). The equation for the use of electronic mail, whether reported or computer-monitored, was significant for DEF ($R^2 = 24$ per cent) and MUN ($R^2 = 20$ per cent), with lower-level job categories using it less. The equations for traditional print media were significant only for R&D ($R^2 = 8$ per cent). These results support H1. Overall, attending meetings is the communication channel by which job categories differ most significantly, followed by telephone and electronic mail. Meetings are also the only medium for which usage varies linearly by organizational level, as noted below.

However, only 15 of the 28 Anovas are statistically significant, so not all forms of media use measured in this study are significantly different across job categories. Part of this lack of significance is due to shared variance among the variables, small sample sizes, and organization-wide use of some basic media (such as print). The question arises, then, as to the adequacy of the media variables when combined in multivariate analyses, both for job category and organizational level analyses.

Table V. Mean differences in media use, by job category, by organization

Use of media	*Job category*					R^2
DEF	*Mngr*	*Engineer*	*Business*	*Admin*	*Secy*	
N	19	27	12	7	18	
Reports	10.5^{a}	20.3^{a}	13.2^{a}	21.3^{a}	18.8^{a}	0.06
Letters	10.8^{a}	10.4^{a}	15.0^{a}	12.9^{a}	17.8^{a}	0.07
Telephone	10.7^{b}	9.8^{b}	15.0^{ab}	20.0^{a}	22.5^{a}	0.17**
Face-to-face	14.5^{a}	22.1^{a}	19.5^{a}	21.3^{a}	14.5^{a}	0.07
Meetings	37.4^{a}	13.6^{b}	12.9^{b}	10.4^{b}	1.8^{c}	0.63**
% using Email	2.5^{b}	1.9^{b}	3.8^{b}	6.3^{b}	10.5^{a}	0.24**
Norm. min/day	0.09^{ab}	-0.30^{b}	-0.02^{ab}	-0.00^{ab}	0.66^{a}	0.12*
Norm. Log-ons/day	0.03^{ab}	-0.38^{b}	-0.04^{ab}	0.42^{a}	0.58^{a}	0.14*
R&D	*Execs*	*Mngr*	*Admin*	*Research*	*Tech*	*Clerical*	
N	14	8	97	26	50	35	
Reports	13.5^{ab}	5.9^{b}	4.2^{b}	19.2^{a}	12.8^{ab}	12.7^{b}	0.08**
Letters	12.5^{ab}	9.7^{ab}	13.5^{ab}	9.4^{b}	7.9^{b}	17.6^{a}	0.08**
Telephone	9.0^{cd}	12.6^{bc}	17.5^{ab}	7.0^{cd}	5.0^{d}	21.4^{a}	0.30**
Face-to-face	20.6^{ab}	22.4^{ab}	25.1^{a}	13.2^{c}	16.5^{bc}	12.7^{c}	0.13**
Meetings	23.8^{a}	15.7^{b}	6.5^{c}	9.7^{c}	8.0^{c}	1.5^{d}	0.30**
% using Email	7.3^{a}	7.1^{a}	7.4^{a}	5.6^{a}	8.2^{a}	5.7^{a}	0.03
Norm. msgs/day	0.37^{ab}	0.75^{a}	0.19^{ab}	-0.06^{b}	0.05^{b}	-0.23^{b}	0.05
GOV	*Mngr*	*Super*	*Prof/Tech*	*Clerical*			
N	12	4	35	10			
Reports	6.1^{a}	5.3^{a}	15.7^{a}	4.9^{a}			0.10
Letters	11.6^{a}	11.3^{a}	14.1^{a}	19.0^{a}			0.04
Telephone	16.0^{a}	18.3^{a}	17.5^{a}	14.0^{a}			0.01
Face-to-face	19.7^{a}	25.0^{a}	13.4^{a}	15.0^{a}			0.09
Meetings	11.4^{a}	5.3^{b}	5.3^{b}	1.6^{b}			0.25**
% using Email	13.1^{a}	10.0^{a}	6.6^{b}	7.0^{a}			0.05
MUN	*Mngr*	*Prof*	*Police*	*Clerical*			
N	30	41	35	20			
Total read/write	20.5^{a}	27.5^{a}	22.9^{a}	23.9^{a}			0.04
Telephone	11.3^{a}	14.5^{a}	14.2^{a}	16.1^{a}			0.02
Face-to-face	16.7^{ab}	15.5^{ab}	21.4^{a}	12.0^{b}			0.08*
Meetings	21.8^{a}	11.8^{b}	8.3^{bc}	3.5^{c}			0.29***
% using Email	9.6^{a}	7.5^{a}	11.6^{a}	9.7^{a}			0.03
Reported msgs sent	7.3^{a}	3.4^{b}	3.8^{b}	4.4^{b}			0.09*
Norm. msgs sent	0.75^{a}	-0.22^{bc}	0.00^{b}	-0.53^{c}			0.20***

This table shows results of ANOVA models (unbalanced design) analysing use of each medium by job category (see Table IV for operationalizations). Means with the same letter ($^{a, b}$ or ^{c}) designation are not significantly different according to the Duncan multiple range test ($p<0.05$). * = $p<0.01$; ** = $p<0.001$.

Table VI. Discriminant functions: canonical structure by media use, and means on function by job category, by organization

(A) Canonical discriminant function structure, with media loadings

	Organization						
	DEF		*R&D*		*GOV*	*MUN*	
Variates: media	*1 Meeting*	*2 Email*	*1 Meeting*	*2 Phone*	*1 Meeting*	*1 Meeting*	*2 Face*
Report	0.21	-0.24	0.09	-0.41	-0.12	—	—
Letter	0.25	0.25	-0.32	0.20	-0.30	-0.17	-0.08
Phone	0.40	0.43	-0.69	0.65	0.04	-0.24	-0.01
Face	0.01	-0.42	0.08	0.42	0.32	0.13	0.74
Meeting	-0.92	0.33	0.80	0.50	0.83	0.85	-0.28
Rep. Email use:							
% day	0.47	0.51	0.18	-0.01	0.32	-0.01	0.29
Msgs	—	—	—	—	—	0.38	-0.28
Mon. Email use:							
Min/day	0.02	0.50	—	—	—	—	—
Log/day	0.24	0.54	—	—	—	—	—
Msgs/day	—	—	0.21	0.35	—	0.71	0.06
Adj. canonical correlation	0.82***	0.52***	0.60***	0.38***	0.52**	0.58***	0.31*

(b) Means of canonical discriminant functions, by job category

	Organization								
	DEF			*R&D*		*GOV*		*MUN*	
Job category	*Meeting*	*Email*	*Meeting*		*Phone*	*Meeting*		*Meeting*	*Face*
Mngr	-2.32	0.65	Exec	1.45	1.27	Mngr	1.24	Mngr 1.22	-0.21
Engr	-0.16	-0.83	Mngr	0.99	0.87	Super	0.34	Prof -0.13	-0.14
Business	0.16	-0.16	Admin	-0.37	0.63	Staff	-0.17	Police -0.19	0.61
Admin	1.04	0.21	Rsch	0.51	-0.26	Cler	-1.01	Cler -1.17	-0.46
Secy	2.04	0.65	Cler	-1.19	0.01				

See table IV for description of differences among media use measures for some organizations. *$p<0.05$; **$p<0.01$; ***$p<0.001$.

Table VI(A) shows that the first discriminant media usage function, represented primarily by meetings, explained from 27–67 per cent of the variance in job categories in each organization. An additional 10–27 per cent was explained by a second function in three of the organizations. Communication through meetings is the major difference in media use among job categories, as the percentage of day spent in meetings is the highest-loading variable on each of the first discriminant functions. For DEF, the second function is characterized primarily by electronic mail, for R&D it is the telephone, and for MUN it is face-to-face communication. These results provide support for H1 because, for each organization, a statistically significant amount of variance among the job categories was explained by one or two functions consisting solely of media use variables.

Table VII shows that patterns of usage of various communication channels is sufficient information to classify most individuals into their correct job categories. Overall univariate tests (Wilks lambda) for the adequacy of discriminant functions

Table VII. Discriminant analysis of job categories by media usage, by organization

	Percentage of observations classified into job categories based upon media usage						
	Job Category						*N*
DEF:	*Mngr*	*Engr*	*Bus*	*Admin*	*Secy*		
Manager	87%	4	0	0	9		23
Business	0	100	0	0	0		12
Administrator	0	0	92	8	0		12
Secretary	0	0	5	87	9		22
Engineer	8	8	3	5	76		37
Percentage correctly classified: 85%; chance classification: 20%							
Comparison to actual job classification: $r = 0.98$*							
Wilk's lambda for discriminant analysis: 0.18*							
R&D	*Exec*	*Mngr*	*Admin*	*Rsrch*	*Tech*	*Cler*	
Executive	100%	0	0	0	0	0	9
Top manager	0	100	0	0	0	0	9
Administrator	7	4	50	21	7	11	28
Researcher	7	4	6	59	16	9	82
Technician	0	8	11	16	60	5	37
Clerical	4	9	16	7	21	44	57
Percentage correctly classified: 57%; chance classification: 17%							
Comparison to actual job classification: $r = 0.87$*							
Wilk's lambda for discriminant analysis: 0.45*							
GOV	*Mngr*	*Super*	*Prof/Tech*	*Cler*			
Manager	93%	0	8	0			12
Supervisor	0	100	0	0			4
Prof/tech staff	20	0	66	14			35
Clerical	10	0	10	80			10
Percentage correctly classified: 75%; chance classification: 25%							
Comparison to actual job classification: $r = 0.90$*							
Wilk's lambda for discriminant analysis: 0.53*							
MUN	*Mngr*	*Prof*	*Police*	*Cler*			
Manager	69%	24	4	4			29
Professional staff	20	48	18	15			40
Police	15	24	44	18			34
Clerical	5	25	20	50			20
Percentage correctly classified: 52%; chance classification: 25%							
Comparison to actual job classification: $r = 0.89$*							
Wilk's lambda for discriminant analysis: 0.51*							

Classification tables show the percentage of cases in the row job category that were classified by the discriminant function(s) (see table VI) into the column job categories. Total row percentages may differ slightly from 100 per cent due to rounding. Within group rather than pooled covariance matrices were used because group covariance matrices were significantly different from pooled covariance matrix. *N* is number in actual job category.

* = $p < 0.01$.

at each site were highly significant ($p<0.001$). The percentage correctly classified ranged from 52 per cent for MUN (compared to a random classification of 25 per cent), to 85 per cent for DEF (compared to a random classification of 20 per cent). Finally, the correlation of the correct job classification matrix with the predicted job classification matrix ranged from ($r = 0.87$ to ($r = 0.98$, $p<0.001$. These results provide additional support for H1.

Organizational Level (H2)

Some statistically significant, and some directional, support for the hypothesized relation between media usage and hierarchical level was provided by differences in use of meetings in all organizations, use of electronic mail at DEF, and face-to-face communication in all organizations except DEF, as shown in table V. Results concerning telephone use were mixed, with two statistically significant and one directional difference indicating higher use by lower-level job categories. The hypotheses did not receive statistically significant support, but did receive directional support from the equations involving use of letters and of reports. Results for use of electronic mail provided no overall support for H2. Individuals in higher job levels in R&D and MUN used electronic mail significantly more than did those in lower job levels, although individuals in higher levels in DEF used it less.

The means for each job category on the first (meeting) function produced by the canonical correlation, as shown table VI(B), are ordered by organizational level. In all organizations except R&D, as individuals occupy higher-level job categories, they report spending more time in meetings. In R&D, researchers spend more time in meetings than do administrators, reflecting (1) their need to work together on research projects, and (2) the higher professional stature of researchers in an R&D organization. In each of the three organizations with a second significant media function, the media use function means are ordered by organizational level, as hypothesized by the social presence/information richness continuum, except for one job category each. In DEF, managers have a high positive loading on the electronic mail function; in R&D, researchers have the lowest loading on the telephone function; and in MUN police have the highest loading on the face-to-face function.

Table VIII reports further tests of the hypothesis that patterns of media usage are associated with differences among organizational level of job categories. The results show that for all organizations, the matrix of the ordering of job categories by hierarchical level and the matrix of mahalabonis distances between job categories produced by the discriminant functions are significantly similar (r's 0.91–0.93, $p<0.05$–$p<0.001$; all quadratic assignment gammas are significant at $p<0.001$). These results provide support for H2.

SUMMARY

Based upon the results from both the meta-analyses and the individual-level analyses, there is considerable support for H1, that job categories can be differentiated on the basis of media use, and for H2, that organizational levels can be differentiated on the basis of the underlying patterns of media use.

Table VIII. Comparison of differences between job levels and distances produced by discriminant media functions, by organization

Organization	*Job Category*				
DEF:	*Mngr*	*Engr*	*Bus*	*Admin*	*Secy*
Manager	0	2.69**[a]	2.67*	3.54*	4.38*
Engineer		0	1.43*	3.20*	5.04*
Business			0	1.52*	2.11*
Administrator				0	1.65*
Secretary					0
Comparison to hierarchy matrix: $r = 0.93$; QAP gamma = 132**[b]					
R&D	*Exec*	*Mngr*	*Admin*	*Rsrch*	*Tech*	*Cler*
Executive	0	1.28	2.12*	1.86*	2.20*	2.96*
Top manager		0	1.53*	1.46*	1.52*	2.44*
Administrator			0	1.35	1.36*	1.12*
Researcher				0	0.71	1.73*
Technician					0	1.73*
Clerical						0
Comparison to hierarchy matrix: $r = 0.92$; QAP gamma = 136**						
GOV	*Mngr*	*Super*	*Prof/Tech*	*Cler*		
Manager	0	1.26	1.54*	2.29*		
Supervisor		0	1.27*	1.56*		
Prof/tech staff			0	1.30		
Clerical				0		
Comparison to hierarchy matrix: $r = 0.94$; QAP gamma = 33*						
MUN	*Mngr*	*Prof*	*Police*	*Cler*		
Manager	0	1.44*	1.66*	2.40*		
Professional staff		0	0.86	1.25		
Police			0	1.46*		
Clerical				0		
Comparison to hierarchy matrix: $r = 0.91$; QAP gamma = 33*						

* = $p<0.05$; ** $p<0.001$.

[a] Values are pairwise distances between job categories based upon discriminant media use function(s). Significance test for Mahalabonis distances is between pairs of job categories.

[b] r is Pearson correlation between a vector of hierarchical distances and a vector of mahalabonis distances. QAP gamma is non-parametrix measure of association between the two matrices, not vectors.

Results from Meta-Analyses

The meta-analyses show variation in mean levels of media use as identified in earlier studies. Larger samples tended to show smaller percentages of face-to-face and total oral communication than smaller samples, as indicated by weighted versus unweighted results (table II). Differences in use of face-to-face, total oral, and total text communication persisted even when biases due to method of data collection were controlled (table III). Self-report and multiple methods tend to under-report face-to-face and total oral communication, and over-report total text communication, compared to observation and diary methods.

Approximately 40 per cent of the variance in use of face-to-face, total oral, writing, and total text was explained by method and managerial/other differences.

Organizational level was strongly correlated with all oral channels ($r = -0.61$ to -0.84 for face-to-face and total oral; $r = 0.51$ and 0.56 for telephone), and unweighted writing ($r = 0.79$) and total text ($r = 0.76$ to 0.90) (table II).

Results from Individual-Level Analyses

The individual-level analyses are summarized using DEF as the example, as it has the strongest and most consistent results.

The DEF job categories have statistically significant different mean levels in use for five of the eight media (table V). The variance in job categories is almost entirely explained (67 per cent + 27 per cent = 94 per cent) by two media use functions (meetings and electronic mail) (table VI), and the overall equation was statistically significant (Wilk's lambda = 0.18, $p<0.001$) (table VII). Eighty-five per cent of the respondents are correctly placed into their job categories on the basis of these two media functions (table VII). And the classification matrix is highly correlated with the actual job category matrix, not considering organizational level ($r = 0.98$, table VII).

The ordering of job categories by organizational level exactly matches the ordering of means of the first discriminant function, and has only one exception (managers) on the second function (table VI). The matrix of pairwise mahalabonis distances between each job category is strongly correlated and associated with the matrix of organizational level distances ($r = 0.93$, QAP gamma $p<0.001$).

DISCUSSION

The following sections discuss some implications and limitations of the study, as well as suggest a few directions for further research.

IMPLICATIONS

The Significance of Meetings

Mintzberg's (1973) classic study of how managers spend their working day is usually relied upon as the basis for asserting that managerial jobs can be distinguished from lower-level jobs by their high reliance on dyadic face-to-face communication. Upper-level job categories *do* spend a large percentage of time in face-to-face communication, as indicated by the meta-analysis, though not as high a percentage as Mintzberg reported. However, the individual-level analyses show that unstructured dyadic face-to-face communication is not the primary basis for characterizing differences in media use among job categories. Rather, attending meetings is. The results of the individual-level analyses reveal what the meta-analysis cannot, both because meetings are typically not measured, and because media usage is typically not analysed in a multivariate fashion.

At least three implications of the significant role of meetings in distinguishing between job categories include: (1) the need to conceptualize better the role that meetings play in organizational information processing; (2) an increased emphasis

on the extent to which meetings provide or require greater organizational co-ordination and integration; and (3) a greater awareness that meetings represent a distinct form of interpersonal communication.

A fourth implication is that researchers and managers need to understand the ways in which new organizational media can facilitate meetings among higher-level incumbents. The results highlight two paradoxes about managerial use of meetings. The first is that, as Hannaway (1987) concludes, more frequent managerial interactions may in fact be a net drain on organizational resources, because they increase the amount, ambiguity and uncertainty of other managers' tasks without necessarily improving organizational information processing. The second is that the very tools that could improve these organizational tasks – computer-mediated communication systems that support group communication (Desanctis and Gallupe, 1987; Galegher *et al.*, 1990; Hiltz and Turoff, 1978; Johansen, 1988; Rice, 1980; Rice and Associates, 1984; Stefik *et al.*, 1987) – are typically perceived as less appropriate for the kinds of equivocality-reducing tasks implied by meetings. However, features such as broadcasting agendas or schedules or meetings through electronic distribution lists may be one way in which such media can complement meetings as methods to process information. Note that in DEF, means for the function characterized by meetings and by electronic mail were highest for managers.

While Kotter, Mintzberg, Thomason and others have developed typologies of generic roles that managers have in organizations, they typically do not consider the important roles required in meetings. An understanding of the characteristics of computer-mediated communication media have led some researchers to develop typologies of role that managers can occupy in mediated groups and to study the consequences of such media for group processes (Kerr, 1986; Rice, 1984).

Implications for Organizational Information Processing Theory

Perhaps the reason why use of the medium lowest in social presence (reading printed text) did not significantly vary much across job categories is that the kinds of tasks involving low levels of social presence, or requiring uncertainty reduction instead of equivocality reduction, may be persuasive throughout most job categories and organizational levels. Further, other characteristics of print media, such as permanence of the record, associations of formal authority and legality (Conrath, 1973; Trevino *et al.*, 1987), and easy accessibility of the medium, may make this medium relevant and necessary to at least some aspects of nearly all organizational information processing tasks.

Most prior research suggests that electronic mail is considered inappropriate for tasks involving high social presence or information richness. This is one reason why higher-level managers are assumed to be not as likely to use electronic messaging than are other organizational members. (Analyses from our data, but not reported here, replicate these assessments of its appropriateness (see note [2]).) However, in two of the present organizations (R&D and MUN), individuals in higher job categories were *more* likely to use electronic mail. These results suggest that electronic mail should not be compared to media such as memos and letters, the least information-rich media, but rather to the telephone, which is generally placed in the middle of information richness/social presence scales. Both media are able to overcome some situational constraints to

communication that face-to-face channels, regardless of their high social presence, cannot overcome, but provide more feedback and other cues than do print media.

This interpretation of the higher-than-expected use of electronic mail at higher organizational levels is in accord with results from other studies. For example, Steinfield and Fulk (1987) found that job pressures and cross-location relations were more important dimensions of communication tasks in influencing media use than was task analysability. Trevino *et al.* (1987) found that managers rated electronic mail as the most likely to be used for communication tasks involving situational constraints. It may well be that managers can use electronic mail for scanning and co-ordination tasks that would otherwise be accomplished less efficiently and effectively by traditional media (Rice, 1987).

In organizations contemplating support of telecommuting, electronic messaging should be implemented not just as an efficient channel for exchanging messages while overcoming temporal and geographical constraints, but also as a mechanism for maintaining group relations and organizational interaction (Steinfield, 1986). That is, there is a danger of evaluating new organizational media only as more efficient substitutes for traditional media with low social presence, when in fact they may fit into, and extend, current patterns of media use.

Organizational Level, Task Interdependence and Media Use

Except for the work of Short *et al.* and Daft and colleagues, and some other researchers cited in this article, analyses of organizational structure typically ignore differences in communication channels. Channels for information flow are typically undifferentiated with respect to differences across job categories or organizational levels. Managing the complexity of internal structure may provide an improved fit to changing environmental demands. But information within various job categories will not reflect the required diversity unless the differentiation between those categories as reflected in their unique patterns of media use is also managed. Thus, boundary-spanners and liaisons can play a potentially important role in co-ordination and integration, but not as successfully if they maintain patterns of media usage that signal hierarchical differences or that restrict the reduction of equivocality across subunit boundaries (Rice, 1987).

It is also possible that a single distinct pattern of media use within a major job category can be an obstacle for internal job mobility and socialization. Organizational development programmes should consider the importance of identifying and modifying an individual's pattern of media use when counselling that individual about both job transfers and promotions.

Mechanistic Organizations and Media Use

While job categories may represent horizontal differentiation, and organizational level may represent vertical differentiation, the extent to which an organization can be characterized by a unidimensional hierarchy may be a third manifestation of task environment. Unidimensionality of hierarchy is one characteristic of mechanistic organizations (Burns and Stalker, 1961; Tichy *et al.*, 1979). A mechanistic organization with a more unidimensional hierarchy is likely to have more clearly differentiated information processing requirements. Department and job boundaries are more likely to be clearly differentiated, with strong norms for media use. Thus patterns of media use should be more distinct across job categories.

The present data do not include good measures of dimensionality of hierarchy. But the qualitative descriptions of the organizations suggest the following ranking of decreasing formalization and organizational hierarchy: DEF, GOV, MUN and R&D. The discriminant classification of individuals into job categories on the basis of media use patterns was more successful in the organizations with possibly more unidimensional hierarchies – DEF (85 per cent correctly classified) and GOV (75 per cent). Further, all the distances between job categories are significant for DEF, while two comparisons are not significant for GOV and MUN, and three comparisons are not significant in R&D. So future studies may extend the present results by considering not only horizontal and vertical differentiation, but also the dimensionality of differentiation, as influences on intra-organizational media usage.

METHODOLOGICAL LIMITATIONS AND ISSUES

Here we note some limitations of the present study, as well as ways in which this and related research on organizational media use could be improved.

(1) Research should include measures of the levels of equivocality and uncertainty present in task environments as well as requirements for social presence.

(2) Research should test for significant differences in the direction of media, such as between sender and receiver or between superior and subordinate.

(3) As with many organizational information processing studies, this study lacks measures of performance, the outcome of major interest to organizational practitioners and theorists. Daft and Lengel (1984, 1986) propose some implications of using different media for organizational design and performance, but future research should attempt empirical validation of these relationships by measuring performance as well. Though Daft and colleagues do use a single unoperationalized measure of performance as reported by respondents' supervisors, there are many components of performance, from the extent to which a medium helps accomplish specific and general tasks, up to organizational-level measures.

(4) The meta-analysis shows that differences in the ways media use is measured accounts for significant variation in levels of use. The four individual-level analyses used similar data collection methods, so variations are not due to method. However, the specific levels of media use may well be systematically biased themselves, because of the reliance on self-report data. More rigorous studies should note possible systematic biases due to methodological differences when comparing results to prior studies. They should also collect computer-monitored data on usage of new media.

(5) Certainly future research should devise more standard operationalizations of job categories. It is appropriate to use the terms and classifications developed by and meaningful for the organizations studied. But it is difficult to generalize implications across job categories in different organizations if there is no common underlying set of definitions.

(6) The analyses reported here measure only the first and last components of the model portrayed in figure 1. Therefore, the analyses make several assumptions. These assumptions do not imply that job categories and organizational

levels differ *only* on the basis of task environment, or that task environments consist *solely* of these two dimensions. Rather, they require only that job categories, and in particular the extreme levels of organizational hierarchy, differ on these two crucial dimensions of task environment in predictable ways. Also, the measure of percentage of the day spent using various media does not assume that more communication necessarily reduces equivocality or uncertainty or even corresponds to the processing of information; the measure represents only relative distribution of media use.

(7) Finally, it may be argued that such a meta-analysis necessarily removes most of the contextual meaning from each study's measures. Certainly in-depth and qualitative studies can reveal the deeper reasons and interpretations of use of particular media for particular activities. However, such approaches also introduce considerable idiosyncrasy and non-comparability into their results. The present results persist through these differences, and through the necessary simplification involved in using only the common data from a wide variety of studies.

CONCLUSION

We suggest here that pattern of use of intra-organizational media is one fundamental characteristic of different job categories and organizational levels. A complete model of organizational media use would consider many more of the known influences on media use (*e.g.*, see note [1]). However, organizational information processing theory specified by a conceptual understanding of media characteristics, as portrayed in figure 1, provides a parsimonious explanation of the strong and consistent results found in over 40 prior studies and these four organizations.

NOTES

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** The authors preferred the leading zeros throughout the figures in this paper removed, arguing that the scale runs from −.9 to .9. However, as this journal's house style is to use zeros in the interests of perceived clarity and consistency, they have not been deleted.

[1] The two other sets of influences have received research attention as well (Culnan, 1984; Dewhirst, 1971; Feldman and March, 1981; O'Reilly, 1982; Picot *et al.*, 1982; Rice, 1987; Rice and Associates, 1984; Rice and Case, 1983; Salancik and Pfeffer, 1978; Schroder *et al.*, 1967; Steinfield, 1986; Steinfield and Fulk, 1987; Tushman and Nadler, 1978; Zmud, 1979; Zmud *et al.*, 1990). (1) Reasons for decisions and actions include: job pressures, accessibility of the channel, intra- versus inter-organizational orientation, lateral versus downward communication, cues and information from peers and superiors as to the significance and consequences of

different media, organizational norms for sharing information and using various channels, and symbolic purposes of communication. (2) Previous experiences include: individuals' cognitive differences in preferences and competencies for using various media, subjective evaluations of media, previous experience with particular media, and individuals' communicator styles.

[2] Although not reported here, two dimensions – appropriateness of electronic messaging for tasks involving low social presence or uncertainty reduction (exchanging information, exchanging opinions, asking questions) (explaining, on average, 32 per cent of the total variance) and appropriateness for task, requiring high social presence or equivocality reduction (resolving problems, negotiation, getting to know someone) (30 per cent of variance) – emerged from a principal components analysis of the six items in three of the organizations. Appropriateness was measured as 0 = no and 1 = yes, then converted to -0.5 and -0.5. The average loading of each of the items was 0.75. Average Cronbach's alpha was 0.63. The means of the former scales (DEF = 0.18, R&D = 0.40, GOV = 0.30) and the latter scales (-0.37,, -0.34, -0.31, respectively) were significantly different from zero ($p<0.05$) in the expected directions.

[3] While electronic communications may also be structured in the form of meetings (*i.e.*, computer conferencing, video conferencing and voice messaging), these forms of organizational media are not as yet very common. See, for example, Rice and Shook (1990). We return to this issue in the discussion section.

[4] Certain job categories, such as production foremen, university presidents and high-school teachers, are not directly comparable to the subject of our analyses, so results from such studies are not included.

[5] For more detail on each of these sites, see Rice and Shook (1988), Rice *et al.*, (1990a), Rice *et al.*, (1990b) and Schmitz (1988), respectively.

[6] The questionnaires for each site were substantially similar, and included other replicated items, not reported here, used by Kerr and Hiltz (1982), Rice and Associates (1984), Rice and Case (1983), Ruchinskas (1982), Short *et al.*, (1976), Steinfield (1986) and Svenning (1982).

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