DOCUMENT RESUME

ED 209 706 CS 503 660

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TITLE Electronic Messaging in the University Organization.
PUB DATE Oct 81
NOTE 23p.; Paper presented at the Annual Meeting of the Speech Communication Association (67th, Anaheim, CA, November 12-15, 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Administrators; Automation; *Communication Research; *Computer Science; Information Networks; *Management Information Systems; *Organizational Communication; *Telecommunications
IDENTIFIERS *Electronic Mail

ABSTRACT

Recent developments in telecommunications technology have made possible local information networks that can connect individuals within organizations of any size, configuration, or purpose. To better understand the impact of such technology, a study of a recently implemented computer based messaging system (CBMS) was undertaken at a large, private university. Questionnaires were administered to and interviews conducted with 74 high level administrative users of the system and to 67 computer services personnel who were experienced CBMS users. The results showed that, overall, the users were satisfied with the system. Other findings were that the system produced positive, but not extreme, benefits; that usage of it reached early stability and then declined; that the users generally agreed upon the tasks for which the system was appropriate; and that it brought about an increase in the users' communication networks. (FL)

ELECTRONIC MESSAGING IN THE UNIVERSITY ORGANIZATION

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October, 1981

Presented to Speech Communication Association, Anaheim, California, November, 1981

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ABSTRACT

Computer-Based Messaging Systems (CBMS) are becoming a commonplace feature of the modern organization. In order to better understand the social impacts of such technologies, a study of a recently-implemented computer-based messaging system was undertaken at a large, private university. Questionnaires and interviews were administered to high-level administrative users at two time periods, and to experienced CBMS users who were computer services personnel. Results generally replicate previous research on the subject, such as finding overall satisfaction with the system, positive but not extreme benefits, early stability and decline in system usage, general agreement concerning tasks for which CBMS use is appropriate, and an increase in users' communication networks. The typical association of system use with these reported outcomes was also found, but more complicated and consequential associations between reported outcomes and "media styles" indicated that simple system use is a significant predictor of few outcomes, while preferences for specific communication channels do predict outcomes. Implications for organizations implementing CBMS are discussed.

ELECTRONIC MESSAGING IN THE UNIVERSITY ORGANIZATION

The development of sophisticated telecommunications hardware and software has given rise to international networks (Roberts, 1978) for the transmission of information. This same telecommunications technology has made possible local networks, which can connect individuals within communities of any size, configuration and purpose.

These telecommunications networks are used increasingly for the exchange of messages between users: The Advanced Research Projects Agency network (the ARPANET), for example, was established so that government-funded researchers could have access to host-computers at other locations, but instead was used predominantly for messaging; the ARPANET messaging facility quickly grew to account for most of the total network communication (Licklider and Vezza, 1978).

Digital networks have become an important means for human communication, as many organizations have adopted computer-based messaging systems (CBMS) to facilitate their intra-organizational communication. The popular names for such systems range from "electronic mail" to "computer conferencing" to "office automation" (Hiltz and Turoff, 1978; Panko, 1980; Rice, 1980a; Uhlig, Farber and Bair, 1979).

With the increasingly widespread implementation and use of such technologies is associated a host of potential social and organizational impacts. Research about such impacts is well-established, and is briefly noted in the section on Research Questions. Designers, vendors, organizational managers and users alike are becoming more aware of the need to understand and, where possible, control these impacts. The present analysis continues in this tradition of understanding uses and impacts of CBMS in organizational settings.

THE TERMINALS FOR MANAGERS PROGRAM

The Terminals for Managers (TFM) program is a pilot CBMS program intended to facilitate communication within the administration of a major west coast university, and eventually to provide other management aids, in the fashion of a Decision Support System (Keen and Scott Morton, 1978). The objectives of the program were 1) to introduce managers to CBMS, and 2) to facilitate further diffusion of such communication technology and service throughout the university by publicizing the TFM experiences of these high-status users.

TFM software includes facilities for the creation, sharing, storage and retrieval of messages. In addition to text-editing, features include "distribution lists" (allowing the user to send the same message to a pre-determined group of individuals); a "cc" function (allowing the user to send copies to other individuals); on-line "help" with TFM procedures; topic summaries and receipt notification for messages; a "tickler" function (for deferral of a message to a pre-determined date); reply, forwarding, delete and listing functions; an on-line user directory; immediate user notification of new mail received; and others. The

TFM system allows message retrieval by subject, keywords, dates, and author. TFM also allows access to other computer operations, including a file system for storage of text or data, a text-formatter for the production of documents, comprehensive data-processing, and a generalized retrieval system to access university-related databases.

RESEARCH QUESTIONS

A variety of usage, attitude, and impact questions were devised From prior research on the impacts of CBMS, the policy objectives of the program developers, and formative evaluation interviews. From this wide range of questions, we primarily discuss results related to managerial communication. We choose this emphasis because, as Bair (1979, 1980) demonstrates, the real payoff in CBMS lies in their use by managers (who spend a large proportion of their time communicating), and because TFM was designed for such managerial use.

Below we present the five categories of research questions considered, and some of the major sources of reviews of each category:

(1) What are the patterns of system use over time?
(Hiltz & Turoff, 1978; Rice, 1980b)

(2) For which tasks is the use of CBMS appropriate?
(Hiltz & Kerr, 1981; Johansen, 1977; Rice, 1980a; Short, Williams & Christie, 1976)

(3) How is CBMS use related to impacts and benefits?
(Bair, 1980; Kling, 1980; Moss, 1981; Uhlig, Farber & Bair, 1979)

(4) How are intra-organizational communication networks affected by CBMS?
(Farace, Monge & Russell, 1977; Hiltz & Kerr, 1981; Hiltz & Turoff, 1978; Keen, 1981; Rogers & Agarwala-Rogers, 1976; Rogers & Kincaid, 1981)

(5) What roles do social distance and preferences for different media play in CBMS use and impacts?
(Johansen, 1977; Short, Williams & Christie, 1976)

EVALUATION METHOD

Beginning in August, 1980, computer terminals were installed in the offices of some 80 senior-level university managers. Portable terminals were made available to those managers who wished to use the system while travelling or at home. This particular group of users was provided equipment, connect time, and computer time free of charge, in order to encourage initial use (thus, as with many pilot systems, results are not necessarily applicable to fully-implemented systems which charge full costs). Each user received personal training, and some users also had their assistants take part in this training.

Among the approximately 200 staff members of the computer services division (CS) (which provided TFM) 110 had chosen to adopt the TFM messaging system at the time of the survey. These CS staff were all experienced computer users, and nearly of all them had been using a similar, but less sophisticated, messaging system before adopting the TFM pack-

age. While a few of those surveyed were full-time managers, the majority worked as user consultants, instructors, and computer programmers.

This paper reports on replication and exploratory results across user groups and time periods. Results from research questions 1, 2 and 5 are compared across two user groups -- managers and CS personnel --- in an attempt to understand how user evaluations of CBMS are influenced by differential experience with, use of, and preference for, CBMS. Results from research questions 1 through 4 for the managers group are compared across two time periods. Research question 5 is more exploratory in nature, as we hope to qualify some of the more straightfoward results found in the earlier literature.

A set of questionnaires for the two user groups was developed, reflecting the evaluation goals noted above. Prior research indicated higher and more unstable usage during one's introduction to a CBMS than at later periods, so two waves of questions were administered. The group which we discuss here is the primary group of managers (N=89), who received a time one (T1) questionnaire within 10 weeks of being introduced to TFM, and a time two (T2) questionnaire from two to five months later. Response rates for T1 and T2 were, respectively, 83 percent (N=74) and 75 percent (N=67). Not all respondents answered both questionnaires, or all questions on each questionnaire. Sample sizes will be reported appropriately. The 110 CS staff received a shorter version of the T2 questionnaire, which excluded questions inappropriate for exerienced users of computer messaging. The response rate for the CS group was 60% (N=66). This questionnaire and the T2 managerial questionnaire were administered within three weeks of one another.

RESULTS

Usage of the System

The primary variables which represent use of TFM, and measures of some potential "causes" of some (positive and negative) impacts, for each time period, include:

(1) frequency of use, or number of times per day one used TFM;
(2) duration of use, or number of minutes per day one used TFM;
(3) potential experience, or number of weeks one had been using TFM.

Table One provides descriptive statistics for these variables.

Reported measures of frequency and duration of use are reliable across time, each correlating significantly and strongly (R=.67, .45 respectively; p's <.001) (although this does not necessarily indicate that repondents are accurately reporting their usage). Neither measure correlates significantly with experience at time one, although both approach significance (frequency: R=.22, p<.05; duration: R=.21, p<.05) at time two. These relationships are not strong enough to prevent the feeling that usage does not increase with simple exposure to the system. (For example, dissatisfied or low users may not have completed the T2 questionnaire. Indeed, the same two correlations based only upon users

TABLE 1. Frequency and Duration of System Usage.

Variable	Time	N	Mean	S.D.	Median	Max
Frequency	T1	74	4.1	5.1	2.8	38
(a)	T2	65	2.6	2.1	2.1	11
(c)	CS	66	6.4	8.5	4.5	58
Duration	T1	73	39.4	43.2	29.9	300
(b)	T2	64	36.7	31.9	30.1	150
(d)	CS	66	92	170	59.2	210
Experience	T1	71	12.2	4.7		22
	T2	89	19.3	6.7		39

For T-tests of changes over time,:
(a) T=2.58, N=50, p<.02
(b) T= .51, N=48, p<.6
For unequal variance T-tests over time:
(c) T=3.27, p<.01
(d) T= .12, p>.40

for whom there were data on correlated variables at both time periods dropped to .07-.09.). Thus, usage levels may simply be an individual trait, for those who accept these kinds of technologies, rather than a function of the technology. As might be expected, CS personnel reported using TFM more frequently and with greater duration.

Concerning changes in use between T1 and T2, there was no significant difference in the values of the duration measure. The slight drop in mean duration is largely due a few extremely high usage values at T1 which declined (e.g., from 300 minutes to 150 minutes for one respondent; almost one-half of the T1 respondents reported usage of between 30 and 90 minutes per day, while only about 30 percent of the T2 respondents claimed this; also note the maximum values in Table One). However, the decline in the values of the frequency measure was significant. These differences in declines show an overall tendency to use TFM less over time, but perhaps to use TFM more efficiently, by logging-on fewer times while staying on the same total number of minutes. Because frequency and duration correlated highly at both T1 and T2 (R=.6, p<.001), and because duration is both stable and unaffected by efficiency concerns, we use duration as the primary measure of usage in several of the subsequent analyses.

As is typical of communication participation measures, these two variables were negatively exponentially distributed (as slightly indicated when means and medians in Table One are compared, but confirmed when tested.) The two sets of variables were recategorized into meaningful and normally distributed values. Frequencies in categories (as shown in Table Two) held well across time, and tests for normality indicate that the recategorized variables, as well as for the experience variable, are

satisfactorily distributed (skewness p's >.4 to .98; kurtosis p's >.06 to .9).

Appropriateness of CBMS for Various Tasks

Table Three shows that respondents felt that TFM was appropriate for the kinds of tasks requiring less social interaction, less social intimacy. The results conform to most prior research on appropriateness of CBMS. We point out here that the Short, et al. (1976) book (which initiated these appropriateness measures) is a very important foundation for understanding how to apply communication technologies to group communication: one particularly crucial point is that, for certain tasks, mediated communications are noticeably more appropriate than face-to-face communication, and in some cases produce more accurate personal evaluations of the interaction.

The earlier literature on appropriateness had a hopeful twist -- some of the less appropriate uses earned more appropriate ratings by respondents after additional experience with and use of communication technologies, including a CBMS. Here, however, with continued (between T1 and T2) use, there is a very slight tendency to feel that initially less appropriate uses become even less appropriate.

For every task except "exchanging information" (and this difference was not significant) CS personnel were more favorable towards TFM as an appropriate medium than were the university managers. The differences between the CS and T2 users in "inappropriate" responses were quite striking, however; these results seem to indicate that a CBMS does not seem as impersonal to experienced computer users as it does to the casual user.

When positive responses to all ten appropriateness measures are summed, and taken to be an overall TFM appropriateness score, the change between the mean score for T1 (5.62, s.d.=1.6) and that of T2 (5.66, s.d.=1.8) was not significant ($T=-.18$, $p>.8$, $N=50$). Overall appropriateness does associate significantly with both recoded measures of usage (but weakly: for duration, $R=.24$, $p<.03$, $N=62$; for frequency, $R=.2$, $p<.06$, $N=60$). Moreover, for the 23 users having responses to any appropriateness measure and whose reported usage frequency was "high" or "heavy", the overall appropriateness score was higher than average at T1 (5.87) and rose to an even higher (but not quite significantly different: $T=-1.63$, $p<.12$) level (6.35) at T2. When the same overall appopriateness measure is calculated for the CS users, the result is a higher level of overall appropriateness for TFM: a mean score of 6.49 (s.d.=1.9) versus an average of 5.66 (s.d.=1.8) for the managers. The CS users' score is very close to the T2 appropriateness score (6.35) for the 23 (***) managerial users who responded to at least one appropriateness measure and who were heavy system users.

In summary, our results support the findings of earlier investigations of the appropriateness of computer-mediated communications, with respect to which kinds of communication tasks may be appropriately performed via CBMS. However, overall appropriateness does not signifi-

TABLE 2. Descriptive Statistics of Recategorized Frequency and Duration Measures.

Usage Categories by User Group	Questionnaire Administration			
	Time 1		Time 2	
Managers	N	Percent	N	Percent
Frequency:				
Low (once)	8	11.4	17	27.9
Medium (twice)	20	28.6	19	31.1
High (3 or 4 times)	23	32.9	15	24.6
Heavy (more than 4 times)	19	27.1	10	16.4
Totals (a)	71	100.0%	61	100.0%
Duration:				
Low (<16 minutes)	22	31.0	21	33.3
Medium (17-60 min.)	39	54.9	35	55.6
High (> 61 minutes)	10	14.1	7	11.1
Totals (b)	70	100.0%	61	100.0%
Computer Services				
Frequency:				
Low (once)			4	6.3
Medium (2 or 3 times)			23	35.9
High (4 to 9 times)			22	34.4
Heavy (more than 8 times)			15	23.4
Totals			64	100.0%
Duration:				
Low (< 21 minutes)			14	23.0
Medium (21-90 min.)			33	54.0
High (> 91 minutes)			14	23.0
Totals			61	100.0%

(a) T-Test: T=4.26, N=48, p<.001
(b) T-Test: T= .52, N=49, p<.6

cantly improve over time, and some specific tasks show declines in appropriateness. We have also found some interesting differences between types of users on the appropriateness of the medium for some purposes. In general, those of our respondents who were most familiar with CBMS or who came to use TFM heavily were more likely to find it a substitutable medium for face-to-face communication. Even as personal an activity as "getting to know someone" was considered fair game for the messaging system by a third of our CS respondents.

Impact on Communication Contacts

One indicator of changes in communication habits and contacts is whether one received messages from, or sent messages to, people whom one did not telephone or write to before TFM was implemented.

At T2, 43 percent of the 58 managers who responded to this question reported sending new communications and reported receiving new communications, while the same percentage reported neither sending nor receiving such contacts. Fourteen percent reported not sending new contacts but did report receiving such contacts. This association at T2 between these two measures is highly significant (Chi-square = 30.3, $p<.001$). As the users are high-level managers, these increases in sending new communications would be primarily lateral and downward in direction. Futhermore, we do not have data indicating who communiated to whom, but open-ended interviews revealed that the highest level personnel began receiving messages from lower-level personnel as well as from the CS staff. The increase in communication contacts could have been either beneficial or disadvantageous; not all managers wanted all of these new contacts. However, the increases are dramatic. Sending messages to new contacts is an active process, though: not surprisingly, a manager who used TFM more tended slightly to send messages to more new contacts (with frequency, $R=.28$, $p<.02$, $N=57$; with duration, $R=.32$, $p<.008$, $N=59$), and, typically is not one to report that recipients of his or her messages did not reciprocate (there were no cases of this at T2). But receiving new contacts is more passive and may also be somewhat due to the attraction of communicating with high-status organizational members; thus only higher duration (frequency, $R=.17$, $p<.12$, $N=56$; duration, $R=.31$, $p<.01$, $N=58$) is equally related with that process.

Thus, a near majority of the respondents reported increased communication contacts, with heavier users tending to report even greater increases in the active aspect of the process. Changes in these communication patterns were not associated with the resondent's managerial unit or status (measured in a variety of ways), however; this result indicates that it is the job or personality traits associated with higher usage that leads to more contacts, and not the organizational identity of the respondent.

Work Benefits of TFM

In an attempt to assess qualitatively the benefits of using TFM, respondents were also asked a variety of questions concerning the perceived effects of TFM on the quantity and quality of their work; on their use

TABLE 3. Appropriateness of TFM for Various Tasks.

Task	Time	N	Percentage Responding: Appropriate	Inappropriate
Exchanging Information	T1	73	95.9	4.1
	T2	66	100.0	---
	CS	66	97.0	3.0
Asking Questions	T1	73	93.2	6.8
	T2	64	95.0	5.0
	CS	64	100.0	---
Exchanging Opinions	T1	71	87.3	12.7
	T2	63	81.0	19.0
	CS	66	95.5	4.5
Staying in Touch	T1	71	80.3	19.7
	T2	63	84.1	15.9
	CS	64	89.1	10.9
Generating Ideas	T1	72	81.9	18.1
	T2	63	73.0	27.0
	CS	64	89.1	10.9
Decision-Making	T1	66	51.5	48.5
	T2	60	46.7	53.3
	CS	55	64.5	34.5
Exchanging Confidential Information	T1	67	29.9	70.1
	T2	60	30.0	70.0
	CS	57	39.4	54.4
Resolving Disagreements	T1	68	20.6	79.4
	T2	59	15.3	84.7
	CS	59	35.6	64.4
Getting to Know Someone	T1	71	15.5	84.5
	T2	62	14.5	85.5
	CS	59	33.9	66.1
Bargaining/Negotiating	T1	67	14.9	85.1
	T2	61	18.0	82.0
	CS	62	32.3	67.7

of the telephone and paper, on the cost-benefit ratio of using TFM, and how difficult it would be to give up TFM. Table Four presents the summary results to these questions.

TABLE 4. Reported Effects and Benefits of TFM

			Percent Responding:				
Effect	Time	N	Significantly REDUCED	Somewhat	No change	Somewhat INCREASED	Significantly
Telephone:							
# Calls made	T1	72	15.3	54.2	30.6	---	---
	T2	64	21.9	45.3	32.8	---	---
# Calls received	T1	72	12.5	52.8	34.7	---	---
	T2	64	18.8	43.8	35.9	1.6	---
Paper:							
Amount produced	T1	72	13.9	43.1	38.9	4.2	---
	T2	64	15.6	39.1	39.1	4.7	1.6
Amount received	T1	72	5.6	38.9	50.0	4.2	1.4
	T2	64	10.9	34.4	46.9	4.7	3.1
Work:							
Quantity	T1	72	---	5.6	51.4	37.5	5.6
	T2	62	---	1.6	53.2	38.7	6.5
Quality	T1	72	1.5	---	62.7	31.3	4.5
	T2	67	---	1.6	67.7	25.8	4.8
			Very difficult	Difficult	Easy	Very easy	
How difficult would it be to do without TFM?	T1	63	11.1	27.0	34.9	27.0	
	T2	61	13.1	29.5	31.1	26.2	
			Exceed	Equal	Less than		
How do the benefits of TFM compare to the time and effort involved?	T1	65	55.4	23.1	21.5		
	T2	62	50.0	19.4	30.6		

As far as respondents could tell, phone calls were reduced more than paper, and quantity of work increased more than quality of work; but a good percentage reported positive changes in each benefit, and only a small percentage reported negative benefits. Indeed, the majority felt that these and other benefits from TFM were worth the time and effort involved, although fewer -- around two-fifths -- felt that it would be difficult to give up this CBMS.

None of the changes between T1 and T2 in responses to these questions was significant, indicating that users had achieved their equilibrium relationship with TFM by T1, or had prior expectations and attitudes about TFM's potential benefits which continued exposure to TFM did not affect.

The question of the relationship between benefits and levels of usage (frequency and duration) is of paramount importance, however: clearly, a manager is interested whether greater use of a CBMS will "lead to" (here, associate with) greater perceived levels of benefits. Using val-

TABLE 5. Associations of Usage with Perceived Benefits.

	T2 Usage Levels of					
	Duration			Frequency		
Benefit or Effect	N	R		N	R	
Reducing calls received	63	.53	****	60	.40	****
Reducing calls made	63	.55	****	60	.44	****
Reducing paper made	63	.28	**	60	.27	**
Reducing paper received	63	.31	***	60	.20	*
Increasing work quantity	61	.44	****	58	.33	****
Increasing work quality	61	.46	****	58	.24	**
Difficulty giving up TFM	61	.58	****	57	.52	****
Benefits exceed time/effort	61	.20	*	59	.12	

NOTE: Results for available cases for each correlation are reported rather than results for the common sample (N=52) because in all instances the lower N produces lower correlations, indicating that light TFM users were less likely to respond to all of these questions. We did not wish to bias results against heavier users. Significance levels of correlations: *: p <.1; **: p <.05; ***: p<.01; ****: p<.005

ues from T2, Table Five presents those associations.

The results indicate that higher levels of duration usage associate quite strongly (for frequency, less so) with more positive responses to the benefit questions, and greater "addiction" to the system. This apparently straightforward result supports vendors' pitches and the fond hopes of many managers who decide to implement CBMS. The one unexpected result is that heavier duration of use does not associate with a strong benefit-to-cost ratio, until one realizes that greater duration of use is, in fact, a higher level of time and effort; perceived benefits reach a point of diminishing (and perhaps decreasing) returns after some threshold of heavy use. We point out again, before preceding to the next sections, that there were no significant changes in these effect/benefit measures between T1 and T2, indicating that people who

tend to become heavy users of CBMS have strong feelings about the appropriateness and benefits of CBMS early on, and continued use over time does not alter these feelings. Without going into detail, respondents seemed also to have less a sense of immediacy about their TFM communications at T2 than at T1. They also showed less willingness to put up with long messages on their screens or printers even though they did not alter their low levels of concern about junk mail and information overload.

Use of Different Channels/Media for Work Communication

Respondents were also asked a variety of questions about their use of different media -- written communication, telephone, interpersonal contacts, and TFM -- as well as about their use of the various TFM commands, which offer different levels of CBMS sophistication and different ways of handling communications with other users. This section simply presents summary statistics for these variables as well as associations with usage, while the next section shows how these variables interrelate as rough indicators of individuals' "media styles". Tables Six and Seven provide the summary descriptions of media and command usage.

Managers spent an equal percentage (about a third) of their time using personal contact and telephones for their work-related communication, followed by writing a fifth of the time and using TFM a seventh. There were no significant changes over time for any channel. However, levels of some of the four media usage variables did associate with frequency of TFM use, duration of TFM use, and potential experience with TFM. Lower percent telephone use correlated with higher duration (.44, $p<.001$) and slightly with the frequency and number of weeks on TFM (.17, $p<.1$); people who had been on the system longer tended to write a smaller percentage of their work-related communications ($R=.21$, $p<.06$), although there was no association with frequency or duration of use; there was no association between percentage of personal contact and any measure of TFM use; and of course experience, duration and frequency correlated significantly ($R=.36$, .53, .35, respectively, all $p<.003$) with percentage of TFM use. Thus although no levels significantly <u>decreased</u> over time -- meaning that TFM does not become a generalized substitute for other media over time -- higher users do use the telephone less. The lack of association of writing with TFM use adds to the suspicion that TFM provides <u>additional</u> communication forms rather than just substitutes for writing; it also provides a hint, discussed below, that using a CBMS is a <u>different</u> style than writing (as well as personal contact) while heavy telephoners are likely to be low users of this medium (or, use of TFM decreases telephone use).

Note that there was no decrease over time in the amount of personal contact reported by managers who used TFM, nor did levels of system use relate to use of this channel, contrary to fears often voiced about increased organizational depersonalization due to CBMS implementation and use. Indeed, CS personnel, who on the average were heavy users relative to managers (and reported a high percentage of TFM use in their work-related communication (30 percent)) also reported the highest percentage of personal contact (35 percent). The CS users did report a

TABLE 6. Use of Channels for Work-Related Communiation.

Channel	Time	Mean	Median	S.D.	Max
Writing	T1	22.6	20.0	15.0	75
(a)	T2	17.7	10.5	12.0	60
(e)	CS	12.2	9.9	10.6	50
Telephone	T1	28.8	26.0	14.8	75
(b)	T2	32.6	30.0	18.4	93
(f)	CS	20.1	15.3	15.0	75
Personal contact	T1	33.5	30.6	17.3	79
(c)	T2	31.1	29.8	16.5	75
(g)	CS	35.0	32.5	19.9	90
TFM messaging	T1	14.0	10.3	11.7	50
(d)	T2	15.5	10.2	14.7	60
(h)	CS	30.0	24.8	19.9	80

NOTE: N for all variables is 72 for T1, 64 for T2, 66 for CS. The Mean represents the mean value of the percentage of respondents' communication which is accomplished over the particular channel. Thus the percentages within a questionnaire administration add up to 100 percent over all four channels.

For all T-tests of changes over time, N is 50:
(a) T = 1.04, $p < .31$; (b) T = .13; $p < .90$;
(c) T = .15, $p < .89$; (d) T = .78, $p < .44$.
(Values for both T1 and T2 were non-significantly higher for all channels except writing.)

For unequal variance T-Tests between CS and T2 values:
(e) T = 1.32, $p < .10$; (f) T = 1.10, $p < .13$;
(g) T = .38, $p > .50$; (h) T = 1.55, $p < .10$.

much lower level of telephone usage and a moderately lower level of writing.

Media Styles, as Indicated by Factors

We are led to some more detailed analyses for the following reasons: usage, appropriateness and benefits did not change much over time; but higher levels of system usage associate with increases in appropriateness and benefits; some managers and most CS users, are heavier users, yet the heaviest (CS) users still reported the highest percentage of personal contacts; and there were similarities in media and command preferences between CS and heavy managerial users. Specifically, we will inquire whether rough indicators of certain personality or job-related differences -- here called "media styles" -- are better explana-

TABLE 7. Usage of TFM Commands and Related Facilities.

Command	Mean Percentage Responding "Yes" T1	T2	CS
Delete message	89.2	96.9	86.4
Return reply	86.5	84.6	80.3
Read message	82.4	81.5	60.6
Send 'carbon' copy	66.2	66.2	71.2
File message on disk	59.5	56.9	77.2
Forward message	41.9	50.8	63.6
Print message	37.8	49.2	56.1
'Tickle' file it	36.5	41.5	56.1
Mean	4.9	5.3	5.6
Maximum	8	8	9
N	74	65	66
Standard deviation	2.0	1.9	2.3

	Time	N	Mean	Median	S.D.
Percentage of TFM messages you print?	T1	74	20.8	10.2	25.5
	T2	61	29.9	19.9	28.4
	CS	66	26.8	20.1	24.0

			Always or almost always	Some-times	Never or rarely
File the copies that you print?	T1	62	41.9	40.3	17.7
	T2	62	46.8	40.3	25.4
	CS	65	35.4	47.7	16.9

			Initiator	Both	Responder
See yourself as initiator of messages or responder?	T2	54	27.8	9.3	63.0
	CS	64	28.1	35.9	35.9

tions of differences in impacts, and benefits than are the straightforward usage levels. The traditional explanation is that greater use, up to a point, associates with greater benefits. We feel that this is too simplistic a conclusion, and could lead to erroneous conclusions for organizational managers implementing, and personnel using, CBMS -- such as a policy to make all employees (at a given organizatinal level, in a particular division, etc.) use a CBMS based on the belief that uniformly positive benefits will accrue. The preceding analyses indicate that "media style" -- a marked personal preference, or job requirement, for using a particular communication channel in getting one's job done -- may be an important factor in a user's use and evaluation of an organization's CBMS.

Because of the small sample sizes and the intercorrelations among the relevant variables, and in an attempt find sets of variables which would serve as indicators of media styles, the primary media and TFM variables were factor-analyzed. Three TFM commands (read, delete, reply) were not included because of their high reported usage by all respondents. Frequency of use was not included due to its high correlation with duration. The variable which asked respondents to rate themselves on a scale as to whether they were primarily an initiator of communications, a responder, or both (the middle value) was added to detect any aspect of activeness or passivity in the use of particular channels.

Table Eight presents the results. Three factors with eigenvalues greater than 1.0, explaining 91% of the variance, resulted after rotating the initial 11 factors. They seem to represent three media styles. The first, called "TFM", is characterized by high duration and percentage of TFM use as well as high use of the copying and forwarding commands, with a very slight indication that such a user tends to be an initiator of communication. Users with a TFM media style do not prefer using the telephone (or their jobs do not call for such usage), or TFM usage can substitute for, and replace, a considerable amount of tele-

TABLE 8. Media Style Factors and Factor Loadings.

Variable	Commun-ality	Factor Names and Loadings: TFM	Personal Writing		TFM as complement
% Writing	.89	-0.13	-0.05	-0.93	-0.07
% Telephoning	.95	-0.65	-0.57	0.38	-0.19
% Personal contact	.90	0.04	0.98	0.07	0.02
Duration of use	.45	0.56	0.04	0.08	0.34
% TFM use	.87	0.83	-0.24	0.21	0.26
Responder	.39	-0.19	0.14	0.05	-0.57
'Carbon copy' use	.36	0.43	0.19	0.09	0.35
Filing use	.26	0.04	0.12	0.04	0.48
Forwarding use	.52	0.68	0.19	0.12	0.03
Listing use	.20	0.29	-0.03	0.29	0.15
Tickler file use	.37	0.22	0.00	0.26	0.49
Eigenvalue		3.13	1.15	1.02	0.57
Variance explained (%)		50.2	24.3	16.4	9.1

NOTE: N = 51;
Factors are Varimax-Rotated Principal Components (Orthogonal).

phone use.

The second factor we call the "Personal" style. Associated with a very high loading by the percentage of personal contact variable are, again, an aversion to (or inverted relationship with) telephone usage, and a slighter aversion to (or inverted relationship with) TFM usage.

The third media style is represented by higher telephone usage, but much more by a low percentage of writing. This "(Non)Writing" style shows a small tendency to use TFM -- basically for listing off text -- and some deferring of files to later times.

The last, non-significant, factor, is primarily characterized by users who consider themselves initiators, and the TFM commands loading on this factor are the more sophisticated ones. Thus, this media style appears to represent complementary use of TFM -- not using TFM to substitute for, or avoid other media, but a style of TFM use which communication initiators without strong channel preferences might take on as a new or additional style.

A last comment on the three factors is that using the telephone does not appear to be an independent media style, but exists only in relation to the three other channels. Thus, those who prefer or need to use TFM, personal contact and writing apparently use the telephone only in inverse relation to each of these others. Using the telephone then may be the channel most likely to be substituted by other channels when they become as available or as efficient. Indeed, one of the primary, and most frustrating, organizational uses of the telephone is to exchange messages. This is precisely one of the communication tasks for which TFM is deemed appropriate, and for which it is most efficient, because the sender does not have to wait for the recipient. Indeed, of the negative relationships involving telephone, the strongest is with TFM. The next strongest, with personal communication, is likely due to the other kind of communication task for which TFM (and other mediating channels) is least appropriate: face-to-face communications involving status, negotiation, getting to know one another, etc.

Having extracted these clearly defined "media style" factors, we now consider whether TFM usage and user evaluation is better specified by media style than by simple levels of usage.

Relationships Among Usage, Media Styles, and Outcomes

If the hints from the preceding analyses are valid -- that something than, or in addition to, a simple usage of TFM is involved in users' reported outcomes (usage, appropriateness, change in communication networks and benefits) -- then we should see some of the explained variance in these outcome measures shift over to media style, or other, variables from the simple usage measures. Three new media style variables were created from factor scores of the first three factors described above (intercorrelations among these new variables were all less than .06). Then, using different sets of outcome variables as dependent variables, separate hierarchical multiple regressions used several variables in the following manner.

Hierarchical entering of the variables is justified here because there is a logical progression in the presumed relationship of certain activities and the later reported outcomes. First comes simple access to the system, most overtly by having a terminal on one's desk. For measures of system usage, the objective measure of number of weeks since receiving training (experience) is more general, and is entered before the terminal-on-desk measure. For changes in communication networks, we posit that organizational status may have some influence on why one would receive new contacts -- lower status managers wanting to communicate with higher status managers, etc. -- and thus a very rough measure of the organizational status of the users' university division (High or low) is entered at this stage. Access to a printer in one's building could affect how a user perceives the levels of paper sent and received, so that measure is entered after the terminal-on-desk measure for paper-related benefits. Then the three factors were entered, in a progression from less to more socially-distant, as defined by Short, et al. (1976): first the "personal" style, then the "non-writing" style, then the "TFM" style. The results of these sets of multiple regressions appear in Table Nine.

Table Nine in general supports our notion that "media style" has a lot to do with reported user evaluations of TFM and its impacts. Indeed, the TFM usage factor/variable has a significant coefficient only for a good cost-benefit evaluation and producing more paper. Curiously, the other two media style variables also associate significantly with the cost-benefit dependent variable: higher use of or preference for personal contact and TFM usage, and lower levels of required or preferred writing, tend to lead to better cost-benefit evaluations. (Table Eight does show that some small use of TFM commands also load on the personal contact factor.) Thus, TFM users who like (or whose jobs require) writing to other organizational members are those who will most likely feel that a CBMS is more trouble than it's worth. In the paper production equation, it is perhaps not surprising that stronger TFM use leads to more paper, particularly if a user has a hard-copy terminal. However, this result counters claims for "paperless" offices stemming simply from use of a CBMS, at least for the first few months.

The regression equation for an overall positive appropriateness score is the strongest in Table Nine, and the non-writing variable is the sole, and strong, significant contributor. Not preferring (i.e., liking or needing) to write (but slightly preferring telephone) is similarily a strong predictor of reported increased work quality, and greater percentage and duration of TFM system use. Preferring to write is a significant predictor of not making new communication contacts (in spite of a non-significant overall equation), of feeling it would be easy to give up TFM, and of feeling that one's work habits were not changed. These results are consistent with a developing picture of a media style which prefers writing, does not much prefer telephoning, and is indifferent to personal contact or TFM; i.e., this style is independent of the two extremes in social distance (personal and electronic), and is thus not likely to be affected much by a CBMS.

TABLE 9. Multiple Regression Results.

Dependent Variable	Constant	Independent Variables, in Order of Entry, and Coefficients: Desk Term.	Personal	Non-writing	TFM	Multiple Corr.
Appropriateness	4.58	.67*	.24	1.47***	.32	R = .59***
Beta wts. (a)		.16	.13	.58	.17	F = 4.78
Work quality	3.39	-.07	-.01	.31***	.08	R = .47*
Beta wts. (a)		-.06	-.02	.43	.14	F = 2.59
Work quantity	3.62	-.17	.02	.09	.14	R = .34
Beta wts. (a)		-.13	.04	.11	.25	F = 1.21
Cost-benefit	1.82	.24	.18*	.32*	.23*	R = .43*
Beta wts. (a)		.13	.22	.29	.27	F = 2.01
Hard to give up	2.51	.18	-.15	-.60***	-.17	R = .61***
Beta wts. (a)		.10	-.18	-.51	-.20	F = 5.42
Habit changes	1.04	.19	-.03	-.21***	.03	R = .52**
Beta wts. (b)		.17	-.06	-.49	.07	F = 2.86
		Printer nearby				
Receive paper	2.51	.08	-.00	.41***	.06	.11	R = .16
Beta wts. (c)		.04	-.00	.05	.05	.14	F = .18
Produce paper	1.86	.27	.07	-.34***	-.21	.25*	R = .49*
Beta wts. (c)		.12	.03	-.37	-.17	.27	F = 2.13
		Organ. status				
Receive contacts	.96	.26*	.07	.02	-.08	-.07	R = .37
Beta wts. (d)		.25	.06	.05	-.13	-.14	F = 1.12
Send contacts	1.36	.03	.08	-.00	-.25***	-.00	R = .38
Beta wts. (d)		.03	.08	-.01	-.38	-.00	F = 1.21
		Weeks	Desk Term.			
Use: duration	2.25	.001	-.43***	.01	.33***		R = .57**
Beta wts. (e)		.01	-.33	.02	.40		F = 5.62
Use: % TFM	16.82	.34	-5.82*	1.67	6.07**		R = .48***
Beta wts. (e)		.17	-.18	.11	.30		F = 3.53

Degrees of freedom:
(a) 4,36 (b) 4,31 (b) 5,33 (d) 5,35 (e) 4,46
Significance levels for coefficients and correlations:
*: $p < .1$; **: $p < .05$; ***: $p < .01$.

The other media style, "personal contacts", associates, as noted above, with good cost-benefit evaluation of TFM, with increased paper reception, but decreased paper production. This inverse relationship with paper might be explained by the fact that TFM usage itself does not enter into the personal factor, but the TFM commands that reduce paper (cc, forwarding, filing) load slightly. The developing picture of this style is one which responds more than initiates, is rather indifferent to TFM, but will use it to do reduce some paper work and respond easily to electronic messages. Under this style incoming electronic messages are noticed precisely because the style represents a preference for personal, and not socially distant, communications.

We note that organizational status did not play a role in the amount of new contacts received or made; having a printer nearby did not play a role in the reported levels of paper received or produced; and simple exposure to TFM did not contribute to predicting TFM duration or percentage usage. Having a terminal on one's desk served as a predictor only in receiving new contacts (confirming our notion of the passive aspect of receiving contacts, as no "style" variable contributed), and in using TFM more (thus confirming the importance of direct access to a terminal).

SUMMARY

This analysis of use of a Computer-Based Messaging System implemented in a university organization for use by high-level managers, and by experienced computer division personnel, has provided replicating results for several of the research questions. Usage levels measured several months after an initial usage measurement were significantly less frequent, although duration of usage remained similar; prior results also show declines and then stabilized usage levels. More experienced users reported higher usage levels, but not much different from the highest managerial users. Both results indicate that "experienced" use of a CBMS can be reached in a matter of months.

TFM was deemed appropriate for precisely the same kinds of communication tasks for which many other communication technologies (other CBMS, teleconferencing, etc.) have been reported acceptable. Typically, these tasks are those not requiring close perceived social distance; that is, for the more personal and sensitive communications. Here, however, although the experienced computer division users evaluated TFM as more appropriate, there was a slight (but not overall) decline in appropriateness for some tasks for the managerial users, who naturally engage in more of the socially close and sensitive communications.

Reported benefits were largely positive, leading to decreased material and media usage, increased work quality and quantity, and increased benefit-to-cost ratio and addiction to the system. These results are also general replications of much prior research. A large percentage of new communication contacts were made and these were primarily lateral and downward, although non-surveyed users of lower organizational status clearly began sending messages upward.

Reported percentage of communication channel use (personal contact, writing, telephone and electronic messaging) showed the two most socially "close" channels, personal contact and telephone, the most preferred, with writing and TEM use trailing.

With respect to the relationship between reported use and reported benefits and impacts, the typical relationship held quite strongly: with some variations and exceptions, greater system use associated with more positive benefits and impacts.

Ordinarily, we would have stopped here and reported an acceptable and repeated conclusion about how such CBMS are good things for the office. But several relationships hinted that this would have been a simplistic conclusion. For example: although usage associated with positive benefits and impacts, there were no changes or increases in these benefits and impacts over a considerable time; the number of weeks on the system did not associate with usage levels; more curiously, the very highest and most experienced users (computer services personnel) reported the highest level of personal contact in their work-related communication; finally, there were no significant changes in percentages of the various communication media used, except for writing. Several explanations arose: total equilibrium usage and relationships occurred very rapidly, and yet were unrelated to the actual number of weeks on the system; people just had a picture in their heads of expected benefits and impacts, and these pictures were unrelated to actual usage levels over time; or there was some more complicated relationship among usage, media use, and reported benefits and impacts.

Factor analysis revealed the existence of something we have called "media styles", which indicate either personality-related preferences or job-related requirements for different communication channels. When entered into multiple regressions involving the benefits, impacts and usage levels as dependent variables, along with a few other theoretically-stipulated variables, these media styles account for almost all the significant predictability of the outcome variables. This is especially true for a media style defined by low levels of writing and mild levels of telephoning -- precisely where a CBMS can best "fit" if appropriate for the task, and is easiest to "ignore" if not.

The implications of these results are three-fold:

(1) Electronic messaging in an organization (here, a university) will have less actual significant impacts than people will attribute to it.

(2) CBMS technologies should be matched to appropriate organizational tasks, rather than indiscriminately thrust into all communication activities.

(3) Personality traits and media styles which affect the use of such technologies will be a major factor in the acceptance, and consequences, of these computer-mediated communication systems.

Hiltz and Kerr (1981: 192) have compiled the most comprehensive review of CBMS impacts to date. Their summation argues that the main

predictors of system use are "motivations of the participant before they ever signed on, rather than reactions to aspects of the system, or skills such as typing speed or previous experience with computers or computer terminals". They also imply that there is no absolute "substitution" or "tradeoff" among media: the main effect is to increase the total amount of communication a person does, and secondarily to decrease a few other media, such as telephone or mail.

We concur, and we encourage researchers and implementors to consider more carefully the relationship between use and outcomes. In particular, we hope to measure personality and job traits more accurately in future research.

NOTE

The authors would like to express our gratitude to Dr. Carson Agnew, Jane Kingston, Linnea Marenco, Dr. Ann Porteus, John Taylor, Marlys White and Ed Williams of the TFM evaluation committee for a fruitful collaboration. We thank Dr. John Jessen for his critical reading of an earlier version of this paper. System users not evaluated here include some paying users on campus and remote users accessing TFM through EDUNET, TELENET, TYMNET, and local telephone; there are currently over 430 TFM users. As of this writing, the TFM system has been reprogrammed to decrease costs and response wait, renamed "CONTACT", integrated into a university-wide communication and support system, and offered at a subsidized price.

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