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Electronic Message Systems in the University: A Description of Use and Utility

by Ronald E. Rice and Donald Case

A detailed study suggests that, contrary to popular belief, people do not necessarily attribute greater benefits to using computer-based messaging as they gain experience; in addition, they tend to prefer different media depending upon the task, their organizational status, attributes of the medium, and their own personalities.

Local telecommunications networks, which can connect individuals within communities of any size, configuration, and purpose, are being used increasingly for the exchange of messages. The Advanced Research Projects Agency network (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 the exchange of messages among the researchers (17).

Many organizations have adopted computer-based communication systems to facilitate their internal communication. The popular names for such systems range from "electronic mail" to "computer conferencing" to "office automation" (10, 20, 21, 22, 30). With the increasingly

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widespread implementation and use of such technologies is associated a host of potential social and organizational impacts. Designers, vendors, organizational managers, and users alike are becoming more aware of the need to understand and, where possible, control these impacts. This article examines the uses and effects of computer-based communication systems in organizational settings, focusing on a pilot program at a major west coast university.

The Terminals for Managers (TFM) program is a system designed to facilitate communication within the university's administration and eventually to provide other management aids (see 13). The objectives of the program were (a) to introduce managers to computer communication and (b) to facilitate further diffusion of such communication technology and service throughout the university by publicizing the experiences of these high-status users of the TFM program.

A university has many of the same needs and uses for a computer-based communication system as do other organizations. However, some of its attributes make a computer system of particular concern (see 8):

- universities are premier information-processing organizations
- creating, handling, and disseminating text among members of the university and within "invisible colleges" is crucial to research productivity and career advancement
- in the near future, scholarly text will commonly be produced, edited, transmitted, reviewed, and typeset (perhaps even "published") entirely electronically
- in status-conscious social organizations such as universities, severe problems of resource allocation may be solved by computer-based communication systems, even though the social structure may strongly resist such redistribution.[1]

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 of a message to other individuals), on-line "help" with TFM procedures, topic summaries and notification that messages are received, a "tickler" function (for deferring a message until a pre-determined date), reply, forwarding, delete, and listing functions, an on-line directory of users, and immediate notification for users that new mail has been sent to them. The TFM system allows messages to be retrieved 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 data bases.

[1] Indeed, 58 percent of the respondents in this study felt that possession of a TFM terminal functioned as a status symbol, while 30 percent believed it did not. Equal percentages—42 percent—believed that this symbolic function would, or would not, cause problems for the university. These perceptions did not change over time.

Questions on the use and impact of TFM and on users' attitudes toward it were devised based on prior research on the impact of computer-based communication systems, the policy objectives of the Terminals for Managers program developers, and formative evaluation interviews. Here we primarily discuss results related to managerial communication, for two reasons. First, the payoff in computer-based communication systems in organizations lies in their use by managers, who spend a large proportion of their time communicating (1, 2); second, TFM was specifically designed for such managerial use. We considered the patterns of system use over time (10, 23), the kind of tasks for which the use of a computer-based communication system is appropriate (9, 14, 29, 31), how use of such a system relates to impacts on and benefits for the work involved (2, 16, 19, 30), how communication networks are affected (6, 9, 10, 12, 24, 28), and how social distance among users and their preferences for different media affect the use and impact of a computer message system (11, 29).

Beginning in August of 1980, computer terminals were installed in the offices of eighty senior-level university managers.

Portable terminals were made available to those managers who wished to use the system while traveling 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, the results reported here are not necessarily applicable to fully implemented systems that 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 university's 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 all of them had been using a similar, but less sophisticated, messaging system before adopting the TFM package. While a few of those surveyed were full-time managers, the majority worked as consultants, instructors, and computer programmers. Of course, CS personnel differed from senior university executives in ways other than their greater computer experience. Indeed, their tasks and organizational culture are quite different (7). The CS users were not intended to serve as a managerial control group. Rather, because their tasks and computer experiences were naturally more appropriate for and sympathetic to TFM usage, their responses could be compared to those of the managerial users for descriptive purposes.

To evaluate how well the system met the objectives for installing it, we developed a set of questionnaires for the managers and CS personnel. Since prior research had shown that usage was higher and more unstable during one's introduction to a computer-based communication system than at later periods, two waves of questions were administered. The primary group of managers (n = 89) we discuss here received one questionnaire within ten weeks of being introduced to TFM (time 1) and another from two to five months later (time 2). Response rates for time 1 and time 2 questionnaires 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 time 2 questionnaire, which excluded questions inappropriate for experienced users of computer messaging. The response rate for the CS group was 60 percent (n = 66). This questionnaire and the time 2 managerial questionnaire were administered within three weeks of one another.

This article describes how both groups used the TFM system and how that use changed over time for the managers. Although there are flaws in terms of project design and data sources because the TFM program was not planned or conducted explicitly by or for researchers, the results do provide useful summaries of how the system was used and offer evidence of users' attitudes and of the impact of TFM on the organization.[2]

To measure respondents' use of the Terminals for Managers system over time, questions focused on the frequency and duration of use and the number of weeks of experience with TFM.

Table 1 shows the number of times per day (frequency) and minutes per day (duration) TFM was used, and respondents' experience (number of weeks they had been using the system). Reported measures of

[2] Additional details on method and results, including user comments, are found in (15). Baseline data are missing because the evaluation team was asked to join the program after initial system implementation. Users were not selected randomly—they were, rather, chosen explicitly to represent high-level university managers. Non-respondents were not sampled for comparison purposes; neither were non-users (although we tried). We attempted to test for levels of usage by comparison with the experienced computer personnel users, and for longitudinal effects by two waves with staggered questionnaire administration. Computer-monitored system usage data, for one week-long period during the middle of the test, did become available, but are not sufficient for comparison with questionnaire data. Average computer-monitored usage figures are reported here, but individual usage figures could not be matched with questionnaire data due to privacy considerations. Finally, the usage reported here is based upon free access as part of the strategy leading to university-wide, fee-for-service implementation. This strategy is typical of pilot demonstrations. A rigorous study of the more comprehensive text-processing system that followed TFM is in process.

Table 1: Frequency and duration of use and experience with the Terminals for Managers program by respondents

	MANAGERS				CS PERSONNEL	
	Time 1		Time 2			
	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$
Frequency (number of times per day)	74	4.1	65	2.6[a]	66	6.4[c]
Duration (number of minutes per day)	73	39.4	64	36.7[b]	66	92.0[d]
Experience (number of weeks on the system)	71	12.2	89	19.3		

[a] $t = 2.58$, $n = 50$, $p < .02$ for t test of changes over time for managers
[b] $t = .51$, $n = 48$, $p < .60$ for t test of changes over time for managers
[c] $t = 3.27$, $p < .01$ for unequal variance t test between managers at time 2 and CS personnel
[d] $t = .12$, $p > .40$ for unequal variance t test between managers at time 2 and CS personnel

frequency and duration of use are reliable across time, each correlating significantly and strongly ($r = .67, .45$ respectively; for both, $p < .001$).[3] Neither measure correlates significantly with the number of weeks on the system at time 1, since managers had only just learned the system, although both relationships approach significance (frequency: $r = .22$, $p < .05$; duration: $r = .21$, $p < .05$) at time 2.

These relationships are not strong enough for us to rule out the possibility that managers did *not* necessarily use the system more just because they had more exposure to or experience with it. When the same two measures are correlated only for users for whom there were data on both variables at both time periods, the correlation drops to $r = .07$ and .09. Thus, rather than being a function of the technology itself, the reported levels of usage may reflect that certain individuals accept these kinds of technologies more than others. As might be expected, CS personnel reported using TFM more frequently and for greater durations than did the managers.

Comparing the duration of managerial use of the system between time 1 and time 2 shows no significant change. The slight drop is largely

[3] We emphasize that usage figures are respondents' reports of their average usage as of when the questionnaires were administered. There is considerable research indicating that respondents' reports of their communication behavior are generally discrepant with their actual communication behavior, although the issue is as yet unresolved (see 3, 4). One would then hope to capture computer-monitored usage data for analysis (see 26) along with questionnaire and other data sources (as in a videotex analysis by Rice and Paisley [27]). Here, daily computer-monitored use was represented by the change in account size from one week to the next, divided by five. Account size reflected all messages received, but only messages sent that were filed, which occurred 95 percent of the time. However, this measure does not include "replies" to received messages—responses not generated as separate messages.

due to a few extremely active users at time 1 whose use declined at time 2 (e.g., from 300 minutes to 150 minutes for one manager; almost one-half of the managers reported usage of between 30 and 90 minutes per day at time 1, but only about 30 percent did so at time 2). However, the decline over time in frequency of use is significant. These differences suggest that managers may have used TFM less often over time but became more efficient, by logging on to the system fewer times per day while staying on nearly the same total number of minutes. Because frequency and duration correlate highly at both time 1 and time 2 ($r = .6$, $p < .001$), 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, frequency and duration are negatively exponentially distributed (as slightly indicated when means in Table 1 and the associated medians [not reported in Table 1] are compared, and confirmed when tested). The two sets of variables were recategorized into meaningful and normally distributed values, as shown in Table 2. Tests for normality indicate that the recategorized variables (as well as the variable for number of weeks on the system) are satisfactorily distributed (for skewness, p ranges from > .4 to .98; for kurtosis, p ranges from > .06 to .9).

Table 2: Normally distributed values for recategorized frequency and duration measures by number and percent of users in each category

	Time 1		Time 2	
	n	%	n	%
MANAGERS				
Frequency				
Low (1 time)	8	11.4	17	27.9
Medium (2 times)	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
Total	71	100.0	61	100.0[a]
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
Total	70	100.0	61	100.0[b]
COMPUTER SERVICES				
Frequency				
Low (1 time)			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
Total			64	100.0
Duration				
Low (< 21 minutes)			14	23.0
Medium (21–90 min.)			33	54.0
High (> 91 minutes)			14	23.0
Total			61	100.0

[a] t test: $t = 4.26$, $n = 48$, $p < .001$
[b] t test: $t = .52$, $n = 49$, $p < .6$

Managers' actual use of TFM was also monitored by computer (see footnote 3, above). This monitoring, conducted for a six-month period (December 14, 1980 to May 19, 1981) in the middle of the program for 105 managers, also indicated rather stable usage over time. Figure 1 shows the median number of messages per account (user) per day (1.6, compared to a mean of 3.1) and the quartiles. The reported decline by the highest-level users is mirrored here in the slight decline of the 75 percentile curve. Academic calendar vacation breaks are also mirrored in actual usage. Averaging the number of messages over the six-month period showed that 27 percent of the managers sent one message every other day. The highest number of messages sent was 15, although only 40 percent of the sample sent more than two messages per day.

Respondents felt that communication via TFM was appropriate for the kinds of tasks requiring less social interaction and social intimacy.

Table 3 shows the percentage of respondents indicating that TFM was or was not appropriate for performing each of ten tasks. For every task except "exchanging information" (and this difference was not

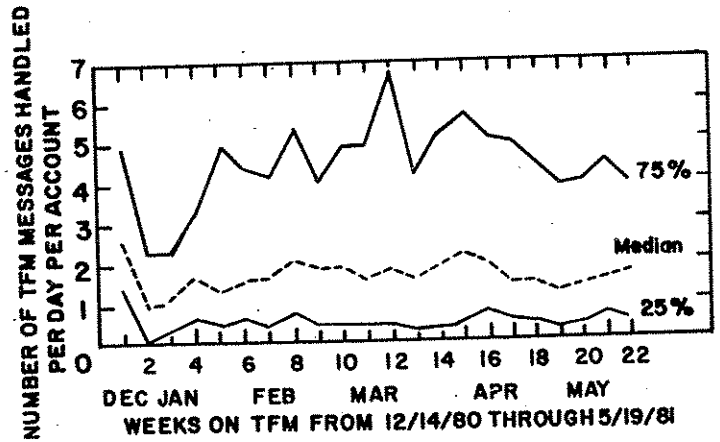

Figure 1: Average daily computer-monitored use of TFM by managers for a six-month period

Source: Kingston *et al.* (15, p. 15). Permission to use granted by Stanford University.

Table 3: Percent of respondents indicating the Terminals for Managers program's appropriateness for various tasks

	MANAGERS		CS PERSONNEL
	Time 1 %	Time 2 %	%
Exchanging information	95.9	100.0	97.0
Asking questions	93.2	95.0	100.0
Exchanging opinions	87.3	81.0	95.5
Staying in touch	80.3	84.1	89.1
Generating ideas	81.9	73.0	89.1
Decision-making	51.5	46.7	64.5
Exchanging confidential information	29.9	30.0	39.4
Resolving disagreements	20.6	15.3	35.6
Getting to know someone	15.5	14.5	33.9
Bargaining/negotiating	14.9	18.0	32.3

Note: By t test, no percentages (means) differed significantly between time 1 and time 2 for managerial response.

For managers at time 1, n ranges from 66 to 73; for managers at time 2, n ranges from 59 to 66; for CS personnel, n ranges from 55 to 66.

significant), CS personnel were more favorable toward TFM as an appropriate medium than were the managers. For those tasks for which users found the computer less appropriate, the differences between the CS personnel and managers at time 2 are quite striking, however; these results seem to indicate that TFM did not seem as impersonal to the experienced computer services personnel as it did to the managers.

Managers' positive responses to all ten measures of appropriateness were summed and taken to be an overall score of TFM appropriateness. The change between the mean scores for time 1 and time 2 is not significant, but managers' judgment of TFM's overall appropriateness is associated significantly with the duration of their usage (but weakly, $r = .24$, $p < .03$, $n = 62$). Moreover, for the 23 managers who responded positively to at least one appropriateness measure and who reported usage frequency as "high" or "heavy," the overall appropriateness score is higher than average at time 1 (5.87) and rises to an even higher (but not quite significantly different) level (6.35) at time 2. When the same overall appropriateness measure is calculated for the CS users, the result is higher (6.49) than for the managers at time 2 (5.66), but close to the time 2 score (6.35) for the 23 most frequent managerial users.

These results conform to most prior research on the appropriateness of computer-based communication systems and alternatives to face-to-face conferencing (29). For certain tasks, mediated communication has been found to be noticeably more appropriate than face-to-face communication and in some cases even to produce more consonant evaluations of the interaction by its participants (29).

In summary, our results support the findings of earlier investigations with respect to the *kinds* of communication tasks that are seen to be appropriately performed by computer. However, users' sense of the computer's overall appropriateness for these tasks does not significantly improve over time, although those of our respondents who were most familiar with similar computer systems 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.

Another 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 time 2, 43 percent of the 58 managers who responded to this question reported sending and receiving such "new" communications, while the same percentage reported doing neither. The remaining 14 percent reported not sending new contacts but did report receiving such contacts. The association at time 2 between these two measures is significant ($\chi^2 = 30.3$, $p < .001$). As the users were high-level managers, most of the "new" communications they sent were probably to peers or lower-level personnel. We do not have data indicating who communicated 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 was not necessarily desired, of course, since not all managers *wanted* all of these new contacts; nevertheless, the increases are dramatic. Not surprisingly, a manager who used TFM more had a slight tendency to send messages to, and receive messages from, more new contacts ($r = .32, .31$, $p < .01$, $n = 59, 58$ respectively).

Thus, a near majority of the managers reported increased communication contacts as a result of using TFM, with heavier users tending to report even greater increases. Changes in these communication patterns were not associated with the manager's unit or status (measured in a variety of ways), however. This result implies that it is the task or personality traits associated with higher usage that lead to more contacts, and not the manager's organizational status. Contacts through other media may also have increased during this period, but the new contacts reported here clearly arose from TFM.

Managers were also asked a variety of questions concerning the perceived effects of TFM on their work and on their use of other media.

Table 4 summarizes the managers' responses to questions on their use of the telephone, the amount of paper produced and received, the quality and quantity of their work, the cost-benefit ratio of using TFM,

Table 4: Reported benefits for managers of the Terminals for Managers system

	Significantly reduced		Somewhat reduced		No change	
	Time 1 %	Time 2 %	Time 1 %	Time 2 %	Time 1 %	Time 2 %
Telephone						
No. calls made	15.3	21.9	54.2	45.3	30.6	32.8
No. calls received	12.5	18.8	52.8	43.8	34.7	35.9
Paper						
Amount produced	13.9	15.6	43.1	39.1	38.9	39.1
Amount received	5.6	10.9	38.9	34.4	50.0	46.9

	Significantly increased		Somewhat increased		No change	
	Time 1 %	Time 2 %	Time 1 %	Time 2 %	Time 1 %	Time 2 %
Work						
Quantity	5.6	6.5	37.5	38.7	51.4	53.2
Quality	4.5	4.8	31.3	25.8	62.7	67.7

	Exceed		Equal		Less than	
	Time 1 %	Time 2 %	Time 1 %	Time 2 %	Time 1 %	Time 2 %
How do the benefits of TFM compare to the time and effort involved?	55.4	50.0	23.1	19.4	21.5	30.6

	Very difficult		Difficult		Easy		Very easy	
	Time 1 %	Time 2 %	Time 1 %	Time 2 %	Time 1 %	Time 2 %	Time 1 %	Time 2 %
How difficult would it be to do without TFM?	11.1	13.1	27.0	29.5	34.9	31.1	27.0	26.2

Note: For time 1 responses, n ranges from 63 to 72; for time 2 responses, n ranges from 61 to 67.

and how difficult it would be to give up TFM. As far as managers could tell, their use of TFM reduced their phone calls more than their paper, and their quantity of work increased more than its quality, but a good percentage reported benefits in each area. Only a small percentage reported negative effects. Indeed, the majority felt that these and other benefits from TFM were worth the time and effort involved, although fewer felt that it would be difficult to do without the program. None of the changes between time 1 and time 2 in average responses to these questions was significant, indicating that managers had achieved a stable set of attitudes about TFM's impacts by time 1 *or* had prior expectations and attitudes about TFM's potential benefits that were not affected by exposure to the system.

Since a manager would likely be interested in whether greater use of a computer-based communication system will "lead to" (here, associate with) greater perceived levels of benefits, the relationship between benefits and duration of use is of paramount importance. We correlated the values for duration obtained from the time 2 questionnaires with the scores on perceived effects. These associations are shown in Table 5. Those managers who used TFM for long periods of time each day had more positive responses to the questions of TFM benefits and seemed to be more "addicted" to the system—except for the perceived cost-benefit ratio. This apparently straightforward result supports vendors' pitches and the fond hopes of many managers who decide to implement computer-based communication systems, insofar as respondents felt that they obtained such benefits because of TFM use.

The one unexpected result is that heavier duration of use does *not* associate with respondents' perceptions that the benefits of TFM greatly outweigh its costs. This may be, however, because greater duration of use does, in fact, represent a higher level of time and effort, and perceived benefits reach a point of diminishing (and perhaps decreasing) returns after some threshold of heavy use. But there were no significant *changes* in responses to these effect/benefit measures between time 1 and time 2. As with the measures for appropriateness, the results indicate that people who tend to become heavy users of comput-

Table 5: Associations of reported duration of usage by managers at time 2 with perceived benefits of the Terminals for Managers program

Benefit or effect	N	R
Reducing calls received	63	.53***
Reducing calls made	63	.55***
Reducing paper made	63	.28*
Reducing paper received	63	.31**
Increasing work quantity	61	.44***
Increasing work quality	61	.46***
Difficulty giving up TFM	61	.58***
Benefits exceed time/effort	61	.20

Note: Results for available cases for each correlation are reported rather than results for the common sample (n = 52).

* $p < .05$
** $p < .01$
*** $p < .005$

er-based communication systems have strong feelings about the benefits of such systems early on, and that continued use over time does not alter these feelings. This result may say more about how people approach new experiences than about computers per se (32).

Respondents were also asked for what percentage of their work-related communication they used writing, telephoning, interpersonal contacts, and TFM. Managers spent an equal percentage (about a third each) of their time using personal contacts and telephones for their work-related communication, followed by writing a fifth of the time and using TFM a seventh of the time. There were no significant changes in percentage of usage for any medium between time 1 and time 2. However, the reported percentages of work-related communication for some of the four media did associate with duration of use and experience with TFM. A lower percentage of telephone use for work-related communication was correlated with a higher duration of use ($.44$, $p < .001$) and correlated slightly with the number of weeks of use of TFM ($.17$, $p < .1$). Managers who had been on the system for more weeks wrote a smaller percentage of their work-related communications ($r = .21$, $p < .06$), although there was no association with duration of use. While no association was found between percentage of personal contact and any measure of TFM use, experience with the system and duration of use, not unexpectedly, correlated significantly ($r = .36, .53$, $p < .003$) with percentage of TFM use.

Thus, managers did not decrease their use of any medium over time—implying that TFM does not come to be perceived as a generalized substitute for other media after a short period of time—but managers who used TFM for longer sessions did use the telephone less. The lack of association between writing and duration of use further suggests that a computer-based communication system may serve as an *additional* communication form rather than as a substitute for an existing one. It also provides a hint, elaborated below, that using such a system is a *different* style than is writing (or personal contact) and that heavy telephoners are not as likely to use TFM.

Contrary to fears often voiced about increased organizational depersonalization due to computer implementation and use, the amount of personal contact reported by managers who used TFM did not decrease over time, nor did levels of TFM use relate to use of this channel. Indeed, CS personnel, who on the average were heavy users of TFM relative to managers (and reported doing 30 percent of their work-related communication via TFM), also reported the highest percentage of personal contacts (35 percent). The CS users did report a much lower percentage of telephone usage and a moderately lower percentage of writing.

Finally, an analysis of respondents' reported use of the various TFM commands in decreasing order of reported use—delete message, return reply, read message, send a "carbon," file message, forward a message, print it, place it in a "reminder" file—found no differences between time 1 and time 2 for managers. Responses of heavy managerial users were similar to those of CS personnel.

The preceding analyses indicate that "media style"—a marked personal preference or organizational role requirement for using a communication medium in getting one's task done—may be an important factor in a manager's use and evaluation of a computer-based communication system.

We are led to conduct some more detailed investigations of these findings, for a number of reasons. First, usage of TFM and users' perceptions of its appropriateness and benefits did not change much over time, but higher levels of system usage did associate with increases in such perceptions. Second, it was the heaviest (i.e., CS) users of TFM who also reported the highest percentage of personal contacts. Finally, there were similarities in the media and command preferences of CS and heavy managerial users. Specifically, we will inquire whether rough indicators of the interaction of task, organizational level, personality traits, and media attributes—here called "media styles"—are better explanations of differences in the reported effects and perceived benefits of TFM than are straightforward usage levels.

The common explanation is that the more a person uses a computer communication system, up to a point, the more he or she will attribute greater benefits to it. We feel that this explanation is too simplistic and could lead to erroneous conclusions for organizational managers who implement, and personnel who use, computer-based communication systems—such as a policy to make all employees (at a given organizational level, in a particular division, etc.) use such a system or to take away other media, based on the belief that uniformly positive benefits will accrue. Precedents for the notion that media attributes, organizational role, and task and personality variables influence the use and benefits of a computer-based communication system are reviewed and discussed elsewhere (5, 9, 25, 29) but are beyond the scope of this article.[4]

[4] Miller and Nichols (18) conclude, for example, that "differences in communication needs, partially determined by role, will affect not only usage but relationships with other factors presumed related to usage."

Because of the small sample sizes and the intercorrelations among the relevant variables, and in an attempt to find sets of variables that would serve as indicators of media styles, the primary media and TFM variables were factor-analyzed, using managers' time 2 scores. Three TFM commands (read, delete, reply) were not included because of their high reported usage by all respondents. One question was added, which asked respondents to rate themselves on a scale as to whether they were primarily initiators of communications, responders, or both (the middle value), in order to detect any aspect of activeness or passivity in the use of particular channels.

Table 6 presents the results of the factor analysis. Three factors with eigenvalues greater than 1.0, explaining 91 percent of the variance, resulted after orthogonal rotation of the initial 11 factors. The three factors can be described as representing three media styles. The first, called "TFM," is characterized by high duration and high percentage of TFM use, as well as high use of the copying and forwarding commands, with a very slight indication that such a style tends to include initiation of communication. The TFM media style does not include using the telephone (or perhaps the tasks of users who display this style do not involve extensive telephone use). It may also be the case that TFM usage can substitute for, and replace, a considerable amount of telephone use.

The second factor we call the "personal" style. It is characterized by a very high loading of the percentage of personal contact variable, associated with, again, an aversion to (inverted relationship with) telephone usage and a slighter aversion to 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 is slightly aligned with use of TFM—basically for listing text—and some deferral of files to later times.[5]

An examination of the three factors indicates 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 for their work-related communication apparently use the telephone *only* in inverse relation to each of these others. The telephone, then, may be the channel most likely to be *substituted* for by other channels when they become as appropriate, efficient, or well-received. Indeed, one of the primary, and most frustrating, organizational uses of the telephone is to exchange messages; this is

[5] A last, non-significant, factor (not presented in Table 6) is primarily characterized by a tendency to initiate communication and to use the more sophisticated TFM commands. Thus, this style appears to represent *complementary* use of TFM—not using TFM to substitute for, or avoid other media, but a style of TFM use that communication initiators without strong channel preferences might take on as a new or additional style.

Table 6: Media style factors and factor loadings

Variable	Communality	Factor names and loadings		
		TFM	Personal	(Non)writing
% writing	.89	−0.13	−0.05	−0.93
% telephoning	.95	−0.65	−0.57	0.38
% personal contact	.90	0.04	0.98	0.07
Duration of use	.45	0.56	0.04	0.08
% TFM use	.87	0.83	−0.24	0.21
Responder	.39	−0.19	0.14	0.05
"Carbon copy" use	.36	0.43	0.19	0.09
Filing use	.26	0.04	0.12	0.04
Forwarding use	.52	0.68	0.19	0.12
Listing use	.20	0.29	−0.03	0.29
Tickler file use	.37	0.22	0.00	0.26
Eigenvalue		3.13	1.15	1.02
Variance explained (%)		50.20	24.30	16.40

Note: n = 51; factors are varimax-rotated principal components (orthogonal). Measures are of managerial time 2 responses.

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 relationship, 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, and so on.

Given these factors of "media style," we can consider whether the way in which TFM is used and users' evaluations of it are better specified by media style than by simple levels of usage.

If something other than, or in addition to, simple usage of TFM is indeed involved in users' reports of the outcomes associated with TFM, then some of the variance in these outcome measures should now be explained by the media style factors or other variables. For the purposes of analysis, the scores of the three media style factors were used to create three new orthogonal media style variables. Then, using different sets of reported TFM outcomes as dependent variables, separate hierarchical multiple regressions were performed.

Hierarchical entering of the variables was justified here because there is a logical progression in the presumed relationship of certain activities and the outcomes of those activities. In addition to the media

style factors, we also had to consider a few other variables that seemed likely to play a role in certain equations.

Simple access to the system, most overtly measured by having a terminal on one's desk, was needed as the first variable in all equations. For equations referring to the usage of the system, the objective measure of number of weeks since receiving training (experience) was essential and, being more general, was entered before the terminal-on-desk measure. For the equations involving changes in communication networks, we posit that organizational status may have some influence on why one would receive or send 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 (low, medium, or high) was entered second in these two equations. Organizational status was also entered into the equation for overall appropriateness of TFM. For the equations concerning paper-related benefits, access to a printer in one's building could affect how a user perceives the levels of paper sent and received, so that measure was entered after the terminal-on-desk measure. For each equation, the three media style factors were then entered, in a progression from less to more socially distant: first the "personal" style, then the "(non)writing" style, then the "TFM" style. The results of these sets of multiple regressions appear in Table 7.

The strongest regression equation in Table 7 is that for an overall positive score for the appropriateness of TFM, with organizational status and "(non)writing" media style very strong contributors and the TFM media style a slight contributor. In a breakdown of the computer-monitored system data by university division, managers from higher-status divisions tended to feel that TFM was appropriate, overall. The six university divisions were President/Provost Office; University Counsel; Business and Finance; Medical Center; Public Affairs, Student Affairs, Athletics, and other smaller groups; and Office of Development. The division of the university making the most use of TFM was Business and Finance, which presumably performed considerable in-house, transaction-based messaging. The number of messages per day averaged about six. Also, Business and Finance had the nearby, heavily computerized business school as a ready model. In contrast, the Development Office was the lowest user, averaging at most one message per day. Their tasks required considerable off-campus and interpersonal communication; furthermore, TFM did not receive as much adoption support in this division. The other divisions averaged between one and four messages per day. Computer-monitored data on the divisional use of TFM also shows that the difference between usage by Business and Finance and all other divisions was large and statistically significant.

Table 7: Multiple regression results showing the impact of media factors on the relationship between reported TFM usage and perceived benefits

DEPENDENT VARIABLES	INDEPENDENT VARIABLES (entered left to right) with beta weights								Total R^2	F
					Media style factors					
	Weeks	Desk terminal	Org. status	Printer nearby	Personal	(Non) writing	TFM			
Work quality	—	−.06	—	—	−.02	.43	.14		.22	2.59
Work quantity	—	−.13	—	—	.04	.11	.25		.12	1.21
Cost-benefit	—	.13	—	—	.22	.29	.27		.18	2.01
Hard to give up	—	.10	—	—	−.18	−.51	−.20		.38	5.42**
Habit changes	—	.17	—	—	−.06	−.49	.07		.27	2.86*
Change in communication network										
Receive contacts	—	.25	.06	—	.05	−.13	−.14		.14	1.12
Send contacts	—	.03	.08	—	−.01	−.38**	.00		.15	1.21
Appropriateness		.11	.53	—	.15	.28**	.21		.61	10.82**
Paper-related benefits										
Receive paper	—	.04	—	.00	.05	.05	.14		.03	.18
Produce paper	—	.12	—	.03	−.37	−.17	.27		.24	2.13
System usage										
Log-duration	.01	−.33**	—	—	.02	.40**			.32	5.62*
Percent TFM	.17	−.18	—	—	.11	.30*			.23	3.53**

* $p < .05$
** $p < .01$

The other equations in Table 7 that reached significance stem from the dependent variables of TFM being hard to give up, leading to changes in users' habits, duration of use, and percent of work done by TFM.

Overall, the results of the analyses support our notion that "media style" has a lot to do with reported user evaluations of TFM and its impacts.

As we had expected, more of the variance in the reported benefits and outcomes was explained by factors of personal and (non)writing media styles. Indeed, the TFM media style is not significantly correlated with any outcome benefit, once other variables are controlled for. Thus, nowhere in the analysis do managers' perceived cost-benefit ratios associate with any usage or style variable; this perception of a high cost-benefit ratio seems to exist regardless of any form of actual system experience or task appropriateness.

Not preferring (i.e., liking or needing) to write (but slightly preferring the telephone) is similarly a strong predictor of reported increased work quality and of 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 in which an individual 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 computer-based communication system.

The "personal contacts" media style associates, as noted above, with favorable evaluations of TFM's cost-benefit ratio and with increased paper reception, but with *decreased* paper production. This inverse relationship with paper might be explained by the fact that TFM usage itself does not enter into the personal contacts factor, but the TFM commands that would tend to reduce the amount of paper (cc, forwarding, filing) do load slightly. Hard copy, of course, provides considerable advantages in terms of portability, transmission, security, leisurely information processing, and other generally positive attributes of print media. The developing picture of this style is one in which an individual responds more than initiates and is rather indifferent to TFM, but will use it to reduce some paper work and will respond readily to electronic messages. In this style, incoming electronic messages are important precisely because the style represents a preference for personal, and not socially distant, communications.

Of the other dependent variables introduced in some of the regression equations, 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 use in terms of duration or percentage of work-related communication. Having a terminal on one's desk served as a predictor only in using TFM more (thus confirming the importance to users of direct access to a terminal).[6] (Users in the top university divisions who scored higher on the "(non)writing" media preference factor *did* score TFM as more appropriate and did score slightly higher on the TFM factor, however.)

Thus, in general, our analysis of the implementation of TFM has replicated much prior research. Usage of the system measured after several months was similar to initial usage, although seemingly more efficient. More experienced computer personnel users reported higher usage levels, but these levels did not much differ from those reported by the most frequent managerial users. Both results indicate that some people can become "experienced" users of a computer-based communication system in a matter of months.

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

Reported benefits were decreased material and media usage, increased work quality and quantity, and increased benefit-to-cost ratio. A large percentage of new communication contacts were made and these were primarily lateral and downward in the organization, although non-surveyed users of lower organizational status clearly began sending messages upward.

Reported percentages of the use of communication channels (personal contact, writing, telephone, and electronic messaging) showed the two most socially "close" channels, personal contact and telephone, to be

[6] Of course, the statistical power of these analyses is quite low due to small sample size, so Type II error is likely to suppress some associations.

preferred more than writing, with TFM use trailing. With respect to the relationship between reported use and reported benefits and impacts, the common explanation held quite strongly: with some variations and exceptions, greater duration of use was associated with more positive benefits and impacts.

While we might have stopped here and reported an acceptable and oft-repeated conclusion about how computer-based communication systems are good things for the office, several relationships and prior research hinted that this would have been a simplistic conclusion.

For example, although TFM usage was associated with users' reports of its benefits and positive impacts, these benefits and impacts were not reported to have changed over a considerable time. The number of weeks users had been on the system did not associate with usage levels. More curiously, the very heaviest 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. (Managerial use of media, and related media style studies, are reviewed elsewhere [25].) 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 moderate levels of telephoning—precisely where a computer-based communication system can best "fit" if appropriate for the task and is easiest to "ignore" if not.

The implications of these results are threefold. First, the positive impacts of electronic messaging in an organization (here, a university) that people report may not be directly—or necessarily—related to their use of the system. Second, computer-based communication technologies should be used where they are appropriate to the particular organization's tasks and managerial styles, rather than indiscriminately thrust into any communication activity. Third, personality traits, job tasks, positions, and media styles that affect how people use such technologies will be a major factor in the acceptance and consequences of these computer-mediated communication systems.[7] We encourage researchers and implementors to consider more carefully the relationship between computer message systems and their effects on organizations.

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[7] Research measuring personality and job traits is currently underway under the direction of Dr. Roxanne Hiltz at Upsala College in New Jersey, and by Dr. Sara Kiesler at Carnegie-Mellon University in Pittsburgh.

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