

Diversity in the Use of Electronic Mail: A Preliminary Inquiry

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This paper describes a series of interviews that examine the ways that professional office workers use electronic mail to manage their daily work. The purpose is to generate hypotheses for future research. A number of implications for the design of flexible mail systems are discussed.

Two principal claims are made. First, the use of electronic mail is strikingly diverse, although not infinitely so. Individuals vary both in objective measures of mail use and in preferred strategies for managing work electronically. Feelings of control are similarly diverse and are related to the size of the user's inbox, numbers of folders, and subscriptions to distribution lists. This diversity implies that one's own experiences with electronic mail are unlikely to provide sufficient understanding of other's uses of mail. Mail designers should thus seek flexible primitives that capture the important dimensions of use and provide flexibility for a wide range of users.

The second claim is that electronic mail is more than just a communication system. Users archive messages for subject retrieval, prioritize messages to sequence work activities, and delegate tasks via mail. A taxonomy of work management is proposed in which mail is used for information management, time management, and task management activities. Directions for future research are suggested.

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1. INTRODUCTION

In a growing number of corporations, electronic mail has become an essential form of communication. As the number of people with access to electronic mail increases, the benefits to individuals increase accordingly. Now that several organizations have more than a decade of experience with electronic mail, it is useful to examine how mail use has evolved and what additional capabilities would best support the needs of users.

Other studies have already demonstrated a number of substantial effects of electronic mail. It can solve certain kinds of problems such as increase the speed of decision making [4] or enable the exchange of new information [7, 14].

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Electronic mail can also create new problems, most notably “information overload” [6, 8, 12]. Sometimes there are both positive and negative effects such as changes in organizational structure [5, 15].

What is the total effect of the introduction of electronic mail? Do organizations with extensive experience with electronic mail evolve new patterns of use that extend beyond the exchange of informal messages? When presented with the opportunity both to address problems created by mail and to use mail to solve other problems, what do users do? When presented with a system such as the Information Lens [13], which provides users with the ability to write personal rules for managing electronic mail messages, what kinds of rules do people choose to write? How do these rules reflect the ways in which people use mail in their work?

This paper describes a series of interviews that identify existing patterns of electronic mail use within an organization. It is hoped that investigation of mail use within a mature electronic mail environment will help us to better understand how to expand the capabilities of electronic communication within organizations and lead to systems that better facilitate collaborative work.

This is a qualitative study. The purpose is to closely observe a small group of experienced electronic mail users and identify characteristic patterns of mail use. The data consist of snapshots of existing mail use, for example, daily quantity of messages sent and received, and interviews about subjective impressions of electronic mail. Participants were asked how they would like to improve their own management of mail and their use of mail to accomplish other tasks. Limited quantitative and qualitative analyses of these data are used to help generate hypotheses that provide the basis for future research. It is important to emphasize that the sample size here is small, and the addition or deletion of one or two individuals would have a large effect on these results. The data presented raise new questions rather than answer old ones.

2. DESCRIPTION OF THE STUDY

Members of a large research laboratory (approximately 60 people) within a major corporation were informed about a study of the Information Lens. Because I was interested only in active users of electronic mail, I described the study and solicited participation via electronic mail. This paper describes the interviews conducted with members of this laboratory and is primarily concerned with current and desired uses of electronic mail. These interviews were conducted just prior to the introduction of Lens; the study of how people actually use Lens is still in progress.

The Information Lens is a prototype electronic mail system which was developed at MIT and designed primarily to help users filter and organize electronic mail [13]. Lens uses semistructured messages which have predefined fields, such as DATE: or MEETING LOCATION:, as well as open-ended text areas. Users can create their own sets of IF-THEN rules, and Lens processes incoming messages according to those rules. The rules can perform various operations such as moving a message to a mail folder or adding information to a calendar program. Lens rules can also be used to identify characteristics of “interesting messages.” One individual may write a rule that fires if a particular message meets certain

criteria. If another person creates such a message and addresses it to "anyone," the first user receives it automatically.

It is important to point out that the description of Lens affected the ways in which people thought about and described their use of electronic mail. It encouraged them to think about the rules they currently use to manage their mail and what it would take to automate them. It also focused attention on certain kinds of problems and provided scenarios for their solution. Individuals were attracted to different features of Lens, and the overall explanation of Lens provided a common ground for discussion.

2.1 Participants

The 23 individuals who were interviewed for this study were selected because they are all extremely active electronic mail users. Some limit their use of the computer to electronic mail and writing activities, whereas others are full-time computer programmers. Participants have a wide range of jobs within the research laboratory. Eighteen decided to try Lens; 5 did not. Of the 18, 15 are full-time researchers, and 3 are managers. Six of the researchers were trained as computer scientists, and 9 were trained in physics, psychology, anthropology, or sociology. The 5 participants who chose not to use Lens included 3 administrators, 1 computer scientist, and 1 manager. The reasons for failure to participate included reluctance to use a prototype mail system, satisfaction with current mail use, and use of an incompatible workstation.

All of those interviewed work in an environment that has supported mail for over a decade. All rely on mail for both formal and informal communication. Their existing mail system operates in a networked workstation environment which permits the use of separate windows for composing, reading, and browsing messages or folders. Messages can be marked with system-defined characteristics, such as moved or deleted, or with characteristics specified by the user. Users can create and name as many folders as they like. The Lens prototype was designed to enhance rather than replace this system; potential participants were told they could choose any or none of the new Lens features, as desired.

2.2 Interview Procedure

The first interviews were scheduled just after the general electronic mail announcement of the Lens study. Several weeks later, my colleagues and I demonstrated Lens at an open meeting, and we invited people to try it. Those who chose to participate in the Lens study were interviewed again, just prior to installing Lens on their machines. Thus, the data reported include one interview for some people and two interviews for others, separated by several weeks.

I scheduled all interviews for one hour in the participant's office. I asked each person to save the current day's mail and delete confidential messages. (No one actually deleted any messages.) I was able to examine the participant's mail messages, inbox, and mail folders and used this information to check the participant's perception of mail use.

After answering general questions about the study, I asked a series of specific as well as open-ended questions. Participants were asked to estimate the daily numbers of messages sent and received, the number of mail folders, the size of

the inbox, and the number of distribution list subscriptions.¹ These answers were checked against the actual numbers for the day and participants were asked if the day was typical. Participants were also asked open-ended questions about major problems and successes with electronic mail. They used this as an opportunity to describe their current communication patterns, successful mail management strategies, problems that needed to be addressed, and whether or not particular Lens features would be expected to help. The actual questions are listed in the Appendix.

3. THREE EXAMPLES

Before examining the overall results of the study, it is instructive to look at three individual cases. These cases have been selected to represent extremes in the use of electronic mail, rather than to identify "typical" users. In order to disguise the identities of the interviewees, their names and some of their personal characteristics have been changed.

3.1 A Classic "Prioritizer"

Mary is a research scientist with a very active personal network. She estimates that she receives over 30 electronic mail messages per day and receives a large number of telephone calls as well. Many of these interactions take the form of personal requests that require her time, for example, reviewing papers, serving on program committees, and offering advice to people at other sites. Other people have become resigned to the fact that she will not always answer her electronic mail or return phone calls; they often find this quite frustrating.

From her perspective, electronic mail is an essential communication medium which also threatens to dictate her life. As a result, she has devised a set of schemes to prioritize her mail to ensure that she sees and responds to correspondence that is important to her. "My goal is to read as little as possible. I try not to read mail more than once a day; I budget my time." In this case, mail is both part of the problem and part of the solution. Because the cost is low for others to reach her electronically, she is inundated with requests, and it is simply not possible for her to respond to all of them. She does not have a secretary or people working for her to whom she can delegate tasks, so she must prioritize them herself.

She is willing to occasionally miss important messages (assuming, perhaps, that people will telephone or get to her somehow if it is *really* important). She has no desire to see unimportant messages. She identifies several categories of electronic mail. Priority 0 requires immediate attention. Priorities 1 and 2 are categorized by sender and only include messages addressed to her personally. Priority 3 consists of bulk mailings, which she browses every couple of months. She sees mail as a way to maintain her large personal network of research colleagues and wants help identifying the most important messages. She feels as if she is on the edge of losing control of her mail.

¹ Estimates of mail use are more relevant than actual numbers in determining the *perceived* feelings of control.

3.2 An Overwhelmed “Archiver”

Ralph is a computer scientist who is responsible for obtaining information from a wide variety of sources and applying it to specific problems. He has hundreds of messages in his inbox and is afraid to delete them because “there might be something important . . . What percent of the ocean don’t you like?” Some of these messages are from personal friends and require lengthy correspondence, some are requests for information or other kinds of action, and others contain information that “may be useful someday” but can not be immediately categorized. Many messages require some form of action on his part and cannot simply be deleted. His meetings and other work prevent him from reading mail on a regular basis. As a result, he often reads only a fraction of his new messages and reserves the rest for “later.” His inbox is always a jumbled mix of unseen messages, unclassified messages, and messages that remind him to do something. He is wary of getting help to do this because it would increase his feelings of lack of control.

One of his most pressing problems is trying to organize his messages in such a way that he can find them again. “I don’t always delete messages after printing them; they’re a reminder in case it gets lost.” His strategy is to delete clearly unimportant messages, leaving the rest in his inbox as a reminder of what remains to be done. He keeps a large number of different mail folders and transfers messages into them on an ad hoc basis. He wants to be able to automatically identify different characteristics of messages once they have been acted upon so that he can use these characteristics to retrieve messages again. He also wants some sort of automatic reminder facility to help him keep track of messages that he still must process.

In general, he views mail as an absolutely essential communication medium for both his job and his personal life. It creates problems because of the volume of messages (he usually has over 600 messages in his inbox and maintains over 40 mail folders), and he feels as if the situation is completely out of control.

3.3 A Manager–Secretary Team

Ann is a manager who is responsible for a group of researchers. Unlike the previous users, she does not use mail to maintain a network of colleagues. She talks to most of her group face-to-face on a regular basis. Instead, mail is an efficient way to keep informed about events in the lab, provides a record of interactions, and is an efficient way to communicate when she is traveling. “If I’m on the road, I use mail for almost everything.”

Her primary problem is managing the volume of mail. Members of her group send her copies of many messages to keep her informed. She would like to offload the management of these messages to her secretary. To be worthwhile, this delegation process must be faster than doing it herself. “I can’t afford to spend more than half an hour a day on mail; it’s an inefficient use of my time.”

Ann and her secretary have developed a shorthand for exchanging and processing mail. Ann flags messages with one of five different actions for her secretary: “please file,” “take some action,” “please reply to,” “for your information,” and “remind me.” The secretary can easily prioritize and handle the

messages without going back to Ann for clarification. Note that this classification scheme is not based on the content of the messages, but rather on the actions the manager chooses to take. Ann wants help in automating this system to avoid the redundancy of copying messages back and forth and to save them both time.

3.4 Analysis of the Cases

These three users exhibit a striking diversity in their patterns of mail use. One user is always “on the edge” of losing control of mail, another is completely overwhelmed, and the third feels very much in control of her mail. As might be predicted, the person who feels most in control receives the fewest messages, keeps the fewest mail folders, and subscribes to the fewest distribution lists. On the other hand, the person who is “on the edge” actually has a significantly smaller inbox than the other two and has the highest number of subscriptions to distribution lists. The perceived level of control does not correspond directly with the objective measures of mail use.

These three users choose to process and organize mail differently and describe the function of mail in very different ways. One person wants help archiving and retrieving messages and views mail as an information management tool. One person wants help prioritizing incoming messages for later action and views it as a time-management tool. The third person uses it effectively to delegate tasks and views it as a task-management tool.

This level of diversity has been reported in other aspects of work, including different writing strategies using NoteCards [17], different desk organization techniques [11], and different styles of information exchange [2]. Although these patterns of use are diverse, they do not appear to be infinitely so. Individuals tend to cluster in their views of mail and the kinds of problems they want it to address. The next section describes the patterns of mail use found in the entire group.

4. PATTERNS OF ELECTRONIC MAIL USE

Participants estimated the daily numbers of messages sent and received and average numbers of mail folders, sizes of mail inboxes, and numbers of distribution lists. These numbers were then checked against the current day's mail, and the user stated whether or not the day was typical. When a range was given, the midpoint of the range was chosen. These estimates, as well as the actual numbers of mail folders and distribution lists, and the user's reported rates of reading mail, are presented in Table I.²

² The mail system in this organization does not explicitly provide electronic conferencing but instead has a very sophisticated distribution list system. These lists are “owned” by someone in the organization who decides whether or not others can add themselves. Some lists are mandatory such as corporate-wide lists. Others are restricted to members of a particular group. Still others are voluntary and include everything from information for users of prototype software to nonwork-related topics (want ads, political action, local entertainment, etc.). When asked to estimate the number of distribution lists, some people answered verbally (e.g., “few”), others guessed a number, and several did both.

Table I

	Messages Sent (Estimate)	Messages Received (Estimate)	Mail Folders (Actual)	Messages in Inbox (Estimate)	Distribution Lists		Reading Rate Messages per day (Estimate)
					(Estimate)	(Actual)	
Managers:							
Sr A	8	30	29	200	12	29	Constantly
Sr B	6	20	6	250	10	21	Once
Sr C		25	15	100	few	37	Intervals
Computer Scientists:							
Sr D	17	75	38	41	many	93	Constantly
Jr E	2	50	26	204	many	75	Constantly
Jr F	10	50	30	85	many	26	Intervals
Jr G	4	40	46	100	many	68	Constantly
Jr H	4	50	89	500	10	46	Constantly
Jr I	7	50	42	600	10	33	Intervals
Other Researchers:							
Sr J	6	30	29	7	36	52	Once
Sr K	6	35	63	450	10	41	Constantly
Sr L	10	50	49	600	20	85	Constantly
Jr M	4	12	8	15	10	19	Constantly
Jr N	5	35	12	80	15	22	Intervals
Jr O	10	35	23	15	10	51	Intervals
Jr P	10	50	20	450	30	36	Intervals
Jr Q	1	17	9	85	7	9	Constantly
Jr R	4	30	22	250	18	43	Constantly
NonLens Users:							
Jr S	30	75	40	10	few	56	Constantly
Jr T	3	20	few	100	11	46	Constantly
Jr U	5	23	100	1,350	10	68	Constantly
Sr V	3	35	11	1,350	6	84	Intervals
Jr W	8	50	15		15		Constantly
Means:	7	39	33	311	14	47	
Ranges:	(1-30)	(12-75)	(6-100)	(7-1,350)	(6-36)	(9-93)	

Most users vary somewhat in their estimates of messages they send (1–10) and receive (12–50) per day. One user, a senior administrator, handles significantly more than anyone else. She sends 30 messages and receives 75 per day.

Users of this mail system can create mail folders in which to store mail messages. Here, the variability among users is much greater ranging from 9 to 100 folders. All job categories show this variability, indicating that job requirements are not the primary determinant of number of folders.

Messages first arrive in a special folder called the inbox. The sizes of inboxes vary greatly, ranging from a low of 10 to a high of 1,350. Those with small inboxes often make a point of clearing them out on a regular basis. Note that small inboxes are not necessarily associated with a low volume of mail. The administrator with the highest volume of mail has the smallest average inbox size. Another administrator with a low volume of mail has one of the largest inboxes.

Users have very different attitudes towards distribution lists. First, nobody has an accurate idea of how many they are subscribed to. Everybody underestimates the number, probably because it is easy to forget about low-volume lists, and people are placed on some lists automatically. Second, some users choose to subscribe to many lists, while others remove themselves from as many as possible. Those in the first category “do not want to miss anything” and are willing to put up with the extra volume of junk mail. Four of the six computer scientists and one researcher placed themselves in this group. Those in the second category are willing to risk missing mail. All of the managers and administrators, most of the researchers (5 out of 9), and one computer scientist are in this category. The remaining people feel that they subscribe to a moderate (and reasonable) number of distribution lists.

The diversity of mail use found in the three examples described earlier is also apparent in these data. While message traffic is somewhat similar, there are large differences in the numbers of messages kept in inboxes and numbers of distribution lists. The difference between the lowest and highest value is at least an order of magnitude in all but the number of messages received. This variability obtains within job categories as well as among them. Note that these items are not all independent of each other because people influence their use of mail. For example, reducing the number of distribution lists directly reduces the number of messages actually received. Similarly, people who do not like clutter may continually delete messages from their inboxes and also maintain a small number of folders.

The size of the inbox also contributes to whether or not users feel in control of mail. Those with very small inboxes are far less likely to feel overwhelmed than those with hundreds of messages. Most people treat the inbox as an on-line “to do” list. “My inbox also holds unclassified mail. It acts as a reminder that something needs to be done.” Not only is it more difficult to find messages in a large inbox, but the very size contributes to feelings that there’s an overwhelming amount of work left to be done.

Users have several ways to limit inboxes. One is to get off voluntary distribution lists and simply never receive a large number of mail messages. Some people are quite willing to do this (“after awhile you get tired of all the junk”), while others are not (“it’s worth it to have to delete 90 percent if 10 percent is interesting”).

One researcher said "I get off as many distribution lists as possible; then I make friends with people who filter them!"

Another way to reduce inboxes is to systematically delete messages after they have been read or skimmed. Some people do this regularly ("I like to prune my mail"), and others let it get out of hand ("If there's a lot of new mail, I do the easiest thing and don't delete. So the garbage builds up."). Several people said that when the inbox gets too big, they copy it to a mail folder, date the folder, and start over.

Preferred frequency of reading mail varies considerably. Two people are very careful to limit mail reading to once a day, usually for a specified period of time. One-third of the people in each job group limit their mail reading to two or three times per day. They allow mail to accumulate and read it only when convenient. The rest of the people read mail as soon as it arrives. This "constant" reading of mail refers only to the time people spend at their desks.

Subjective reports about feelings of control sometimes refer to rates of reading mail. Some feel that mail is seductive and carefully restrict their mail reading, either by limiting the actual time spent or by restricting the number of times mail is retrieved per day. Others treat the appearance of a "new mail" message as if it were a telephone call; they retrieve mail as soon as it arrives. Those who feel out of control are often those whose jobs do not require immediate responses to mail but feel they can not stop themselves from reading it anyway.

5. SUBJECTIVE VIEWS OF MAIL

The next two sections present data that result from an exploratory analysis of users' subjective views of mail based on the open-ended interview questions. Two observations emerged during the early interviews. First, individuals differ greatly in their feelings of control over their mail. Second, individuals either ask for help prioritizing their incoming messages or in archiving them for later retrieval. (A few users requested both.) I was interested in how these categories correspond to different patterns of mail use.

Individuals interviewed in the latter part of the study were explicitly asked to rate their feelings of control over mail and specify a preference with respect to prioritizing or archiving mail. For those who did not provide an explicit categorization, I made subjective judgements based on the following criteria: I rated users as "OK" if they did not report difficulty finding messages, read as much of their mail as they felt was important, and felt they had effective strategies for managing their inboxes. I rated users as "overwhelmed" if they reported serious problems finding messages, were unable to read all of their mail, and were unable to manage the mail in their inboxes. I rated users as "on the edge" if they reported some success in these areas but were not satisfied with their ability to manage their mail.

Similarly, I rated users as prioritizers if they specified that they were interested in rules that ran before reading their mail or if they maintained one or more folders for "high priority" activities. I rated users as archivers if they explicitly refused to run rules prior to reading mail and also maintained a large number of subject-based folders but no "priority" folders. Users were designated as both if they wanted rules to run in both occasions and maintained both kinds of folders.

Table II. Feelings of Control over Electronic Mail

Feelings of Control	Messages Sent	Messages Received	Total Folders	Inbox Size	Distribution Lists	Interview Data
"OK"	<i>n</i> = 8					
Mean	8.29	30.50	21.00	84.38	38.38	3 Senior
Standard Deviation	9.98	20.23	16.15	78.67	20.52	5 Junior
Range	1-30	12-75	6-46	10-250	9-68	
"On the Edge"	<i>n</i> = 8					
Mean	7.5	44.38	32.50	407.43	65.57	6 Senior
Standard Deviation	4.66	15.22	17.19	466.61	24.78	2 Junior
Range	2-17	30-75	11-63	7-1,350	29-93	
"Overwhelmed"	<i>n</i> = 7					
Mean	6.43	41.14	45.00	473.57	39.14	0 Senior
Standard Deviation	2.64	11.58	35.21	436.13	15.32	7 Junior
Range	4-10	12-100	12-100	80-1,350	26-68	7 Archive

Table III. Prioritizing Versus Archiving Electronic Mail

Processing Patterns	Messages Sent	Messages Received	Total Folders	Inbox Size	Distribution Lists	Interview Data
Prioritize	<i>n</i> = 7					
Mean	9.83	32.00	21.86	61.71	36.14	5 OK
Standard Deviation	10.36	20.58	11.81	72.07	18.02	2 On Edge
Range	1-30	12-75	9-40	7-200	9-56	0 Overwhelmed
Archive	<i>n</i> = 13					
Mean	7.23	49.92	40.85	502.17	50.69	6 Overwhelmed
Standard Deviation	3.83	14.59	29.00	440.85	26.05	5 On Edge
Range	4-17	20-75	6-100	41-1,350	15-93	2 OK

I then compared the patterns of use for each category described above. These data are summarized in Tables II and III. Because of the small sample sizes, most of the differences between groups are not statistically significant.

5.1 A Methodological Note

It is important to emphasize that this approach is designed to generate testable hypotheses, rather than to draw conclusions about the validity or generality of those hypotheses. These hypotheses are derived from one part of the data and are examined with respect to the whole group. They have a theoretical basis and fit the current set of data. Additional tests with a larger number of users from a different population are necessary to determine whether or not these patterns of use are generalizable.

5.2 Feelings of Control: Does the User Manage Mail or Does Mail Manage the User?

Subjective views of mail also reveal diversity in perceptions of mail use. Differences in feelings of control over mail are particularly interesting because they do not always correspond to more objective measures of mail volume. For example, one person felt that 36 distribution lists was "a few," while another felt that

20 was "a lot." One person felt in control with 75 messages a day, while another felt overwhelmed with 23. This section suggests factors that may influence these feelings of control and hypothesizes about how they relate to different strategies of work management.

Some people seem quite content with their electronic mail and feel that they use mail successfully in their jobs. ("I trim my inbox and don't hoard things. I don't have trouble finding things.") These people have been categorized as "OK". They

- (1) do not try to read all of their mail messages.
- (2) remove themselves from voluntary distribution lists.
- (3) keep their inboxes small.
- (4) keep a small number of folders.

Other people describe themselves as out of control ("I am overwhelmed by mail") and constantly feel that they are missing information and forgetting to do things because of it. ("I don't read all my mail. There's too much. I sometimes miss meetings and things because I didn't see the message.") These people have been categorized as "overwhelmed". They

- (1) read mail at irregular intervals or constantly.
- (2) try to read all of their mail but do not always succeed.
- (3) keep hundreds of messages in their inboxes.
- (4) often do not get to the bottom of an inbox.
- (5) want to save a large percentage of their mail.
- (6) maintain many mail folders on diverse topics.
- (7) have difficulty finding messages.

A third group describe themselves as barely able to maintain control over their mail. ("I intend to read all my mail ... someday!") These people have been categorized as "on the edge." They

- (1) read mail at irregular intervals or constantly.
- (2) try to read all of their mail but do not always succeed.
- (3) keep hundreds of messages in their inboxes.
- (4) have difficulty finding messages.
- (5) subscribe to many distribution lists.

Table II shows how the patterns of mail use differ among these three categories. Interestingly, individuals in the "on the edge" category do not appear to be simply at an intermediate point between "OK" and "overwhelmed." They maintain an intermediate number of folders, but their inboxes are roughly the same size as those in the "overwhelmed" category, and they receive similar numbers of messages. They are markedly different with respect to distribution lists, subscribing to twice as many as people in the other two categories (who are roughly equivalent). Essentially, the "on the edge" group deals with the same volume of mail as the "overwhelmed" group but appears to manage it more effectively.

One possible explanation for the differences between "overwhelmed" and "on the edge" users may be related to seniority in the lab. All of those in the "overwhelmed" category are junior members of the laboratory, whereas almost

all of those in the “on the edge” category are senior members. On the other hand, seniority is not sufficient to determine feelings of control because equal numbers of junior and senior lab members appear in the “OK” category. Job responsibilities were evenly distributed across the three categories.

The data here suggest that users differ significantly in their feelings of control over their electronic mail. Those in the “overwhelmed” category appear to be experiencing “information overload,” an increasingly common problem [1]. Weick [20] claims that information overload relates to the one-to-one correspondence between input and output of messages, electronic or otherwise. Such predictions become relatively easy to test when studying which factors increase or decrease perceptions of information overload with electronic mail.

Another question is how feelings of control over mail relate to feelings of control over work in general. These may be the same or may differ on the basis of the percentage of work that is received electronically as opposed to via other means. Presumably junior members of the lab receive a greater percentage of their work electronically, which matches the general findings. Additional research is necessary to understand how mail use changes with respect to this factor.

5.3 Mail Handling Strategies: Prioritizers and Archivers

During the open-ended section of the interviews, I asked users what kinds of rules they would like to apply to their mail. It quickly became apparent that the specification of rules was dependent upon *when* the user intended the rules to be run. This distinction affected the content of the rules requested and the kinds of work problems the user wanted to address.

Subjective views of mail also reveal diversity in mail handling strategies. Some people want a system that manages their mail before they see it. Others are adamant about reading all of their incoming mail first but want subsequent help to store and later retrieve messages.

I classified individuals with the first preference as *prioritizers*. These people are interested in limiting the time spent with mail and maximizing efficiency. They want help in selecting important messages for immediate viewing, deleting unimportant ones, and organizing the rest for efficient handling later. They are willing to risk the possibility of missing an important message in exchange for increased efficiency in managing their mail. These individuals

- (1) do not read all of their mail.
- (2) limit the number of times they read mail per day.
- (3) reduce mail volume by getting off distribution lists.
- (4) keep fewer messages in their inboxes.
- (5) keep fewer mail folders.

People interested in prioritizing their mail were not necessarily more successful at managing their time than other people. They were, however, more likely to describe time management as a salient issue in their current work. Differences reported in how messages are perceived over time were consistent with research in the perception of time [3, 9].

I classified individuals with the second preference as *archivers*. These people want to ensure that they see all incoming messages and are willing to spend the extra time necessary to avoid the possibility of missing something important.

They want help in categorizing and storing messages and want better tools for subsequently finding them. These individuals

- (1) increase mail volume by subscribing to voluntary distribution lists.
- (2) save a large percentage of their mail messages.
- (3) maintain a large number of mail folders.
- (4) tend to read all of their mail or try to.
- (5) have difficulty finding mail that has been filed.

Archivers are not necessarily pack rats who can not bear to throw anything away. Instead, they identify the gathering, digesting, and distributing of information as an important part of their jobs. They do not view eliminating “unimportant” messages as particularly useful. “I don’t trust a formula for sorting mail before I see it. I’m afraid it will get sorted and I’ll never look at it again. I prefer to read it manually and then have it sorted for me.” Because they feel they have to process everything anyway, they want tools that help them classify interesting messages. They also want a consistent scheme for storing messages to facilitate later retrieval. Some of these people are very organized and have developed efficient filing systems for their messages. Richer retrieval mechanisms and faster access times would be appreciated but would probably not fundamentally change their jobs. Others are very disorganized and have a difficult time finding anything. These people probably need help with time management as much as help with archiving.

Table III shows the differences between those who prefer rules for prioritizing their messages and those who prefer rules for archiving their messages. “Prioritizing” and “archiving” are not mutually exclusive, although people in this study tend to have a preference for one or the other. Those interested in both or neither are not included in the table.

As with Table II, this table is generated from the interview data and is not the result of testing a hypothesis. With this caveat in mind, it is interesting to note that those who want to prioritize their mail manage to maintain much smaller inboxes and are more likely to feel in control of their electronic mail (“OK”) as opposed to “on the edge” or “overwhelmed.” Preference for prioritizing also appears to correspond with fewer folders and subscription to fewer distribution lists. These results are consistent with the interviews. No programmers appear in the prioritizing category, although other job categories, both junior and senior, appear in both. Rates of reading mail are evenly distributed between the two groups.

Senior members of the lab do not differ much from junior members in terms of messages sent and received, rates of reading mail, or categorization as prioritizer or archiver. Among senior members, managers have significantly larger inboxes than their senior research colleagues (mean = 475 versus 225). Senior members of the lab are less likely to describe managing information as a major problem in their work and state that they rely on junior members of the lab for this function. On the other hand, junior members of the lab appear to be less experienced at managing their time and far less willing to delegate the problem to others. They tend to be less likely to request rules that help them manage time spent reading mail or accomplishing tasks delegated electronically. Future

studies are necessary to see whether time management and information tools will blur these distinctions.

5.4 Delegating Tasks by Mail

Researchers have examined the process of delegating tasks within an organization [10, 21]. This study suggests that mail is also an effective medium for delegating tasks. Managers and secretaries establish patterns that facilitate the exchange of tasks. Members of groups use mail as an efficient way to allocate tasks to the individual who is least busy or most competent to handle a particular problem.

The burden of handling electronically assigned tasks is often distributed disproportionately throughout the organization. In some sense, any request for action is a delegation of a task. On the other hand, the significance of the tasks delegated varies significantly across job responsibilities. Some people, particularly managers and high-level administrators, request more tasks. Others, usually individual contributors and secretaries, more often respond to these requests. Senior researchers appear to fall between the two extremes.

Senior members of the organization should, presumably, feel less overwhelmed by mail than their more junior colleagues. Not only do they receive a relatively smaller percentage of their work load via electronic mail, but electronic mail also provides an efficient mechanism for further delegating tasks. Junior members of the organization may be unable to refuse or delegate tasks they receive electronically, which would increase their feelings of being overwhelmed. In contrast, senior researchers may receive a similar number of requests but be able to refuse them or more easily hand them to someone else. This may be another explanation for the differences between the “overwhelmed” and the “on the edge” groups.

6. A TAXONOMY OF WORK FUNCTIONS ACCOMPLISHED WITH MAIL

Studies of organizations have identified and investigated characteristic patterns of work and how people manage their time. For example, Webber [19] categorizes activities in terms of order of arrival, level of urgency, and importance. Trickett [16] identifies four continua of work activities: intrinsic importance, urgency, delegation, and visitations. I have argued that electronic mail contributes to at least three functions of work: information management, time management, and task management. The specification of these functions emerged from the requests people made for rules to help manage their electronic mail. They are not mutually exclusive, although individuals usually choose mail handling strategies that support only one or two of these views of work.

The effectiveness of different mail handling strategies is influenced by job requirements and status within the laboratory. For example, some people who feel overwhelmed with too many messages can reduce the number of distribution lists they subscribe to. However, those whose jobs involve tracking information cannot simply remove themselves from distribution lists. They must actively manage the information that comes in via mail and archive it in such a way that they can retrieve it when it becomes relevant. These users view mail in terms of *information management* and use it to manage large quantities of information.

Some people receive a large percentage of their work assignments via mail, which creates a choice about when these tasks will be done. People who feel

overwhelmed by mail often allow the order in which messages are received dictate the order in which tasks are performed. Individuals with jobs that require immediate responses, such as fixing broken equipment, often have no other choice. However, of those who can afford to wait before responding to any particular request, those who actively prioritize feel in greater control of their mail. These users view mail in terms of *time management* and use it to identify tasks and prioritize them.

The third work function that emerged was the delegation of tasks, both large and small, via electronic mail. One of the functions of electronic mail is to lower the cost of deciding who should perform which task. Some delegation patterns are easy to examine such as those between a manager and a secretary. Others are more complex, such as deciding which member of a software development group should fix a particular "bug." New bug fix requests come into the group via a distribution list, and the appropriate member of the group either accepts the task or uses mail to request help from other members. These users view mail in terms of *task management* and use it to allocate tasks among group members.

These work functions can be summarized as follows:

- (1) *Information Management.* Especially relevant to individuals responsible for gathering information, digesting it, and providing it to others. Electronic mail is both a source and a repository of information.
- (2) *Time Management.* Relevant to everyone, especially those who perform a high number of electronically assigned tasks. Strategies for ordering tasks range from performing them in the order they arrive to complex organizations of priority folders.
- (3) *Task Management.* Relevant to everyone, especially those who perform a large percentage of their work electronically. Task exchanges are established among small work groups and pairs.

7. IMPLICATIONS FOR THE DESIGN OF ELECTRONIC MAIL SYSTEMS

The observation that users perform different work functions with electronic mail has important implications for the design of mail systems. Comments such as "Mail is my lifeblood" indicate the level of importance of mail in this organization. Because everyone can be assured that everyone else has regular access to electronic mail, these people have adapted mail to support different kinds of work. Examining these "lead users" of mail [18] can inform the design of future mail systems in several ways. Not only will it help identify limitations in current mail systems, but it may also challenge assumptions about the purpose of mail systems and suggest new approaches that support diverse uses of mail.

The level of diversity found within this small group argues against searching for a single correct mail strategy. Instead, it is important to look for powerful primitives that support the flexible extension of mail to aid different kinds of individual and group work. Because no single set of rules is likely to be useful for everyone, providing users with the ability to write their own personal rules should be an effective solution.

Groups should benefit from tools that help distribute tasks throughout an organization. A number of users in this study requested special types of messages

and rules for this purpose. Two managers want to establish routine communication between themselves and their secretaries. Another is interested in creating "organizational processes for handling short-lived groups." Others are members of existing groups that handle routine requests from the outside, mostly bug fixes and requests for information. They are interested in rules that can help them allocate tasks among themselves.

The information management function needs an improved system of classifying and retrieving messages. Combining semistructured messages and intelligent information retrieval techniques may prove both practical and powerful. The time management function needs better ways of identifying and sequencing important messages. The importance of a message has as much to do with the current state of the user as the content. Effective time management tools must provide ways for the user to include information about context when processing the content of messages. For example, rules for handling messages should vary according to how busy the user is. The task management function needs better ways to determine who is best suited to perform a particular task and assign it accordingly. "Best suited" must include some indication of the current workload of the performer of the task to prevent people from becoming overwhelmed.

This study indicates that no individual is likely to have experienced the range of mail handling strategies possible, nor be aware of all of the different work functions that mail is routinely used for. Thus, it is important that ideas such as those raised in this paper be systematically tested with large groups of mail users, both to better understand how people in organizations use electronic mail to perform work and to generate ideas for improving future mail systems.

8. SUMMARY AND SUGGESTIONS FOR FUTURE RESEARCH

The most striking result of this study is the level of diversity in patterns of mail use. Basic mail functions, such as numbers of mail folders, numbers of distribution lists, and sizes of inboxes, vary by at least an order of magnitude. Individuals also vary greatly in their feelings of control over their mail, ranging from completely in control to totally overwhelmed. Much of this diversity can be explained by the differences in people's work and how that affects their views of mail.

In this organization, mail has evolved beyond a passive communication system. Because everyone can assume that everyone else has access to mail, mail has become an integral part of everyone's work. Mail is both a source of additional work and a tool for managing work. It should not be surprising that mail has come to reflect the diversity found in that work.

Three major forms of work management have been identified: information management, time management, and task management. Those who view mail as a time management tool, called prioritizers, are most interested in identifying and prioritizing important messages. Those who view mail as an information management system, called archivers, are most interested in sorting and retrieving messages. Those who use mail for task management, are most interested in assigning tasks to those who can perform them most efficiently.

Viewing mail as support for different kinds of work can help in the design of successful mail systems. An important lesson here is that an individual designer's

own experience with mail is unlikely to provide sufficient understanding of how other people want to use mail. Mail systems should be designed to accommodate diversity. Rather than searching for an optimal set of functions, designers should seek primitives that provide both power and flexibility. With these features, mail can be more than just a communication system: It can be a sophisticated tool for accomplishing a wide variety of individual and group work.

APPENDIX: Interview Questions

Participants were asked the following sets of questions:

A. Descriptions of Electronic Mail Use

- (1) How many messages did you send today?
- (2) How many messages did you receive today?
- (3) Is this a typical day?
- (4) How many mail folders do you have?
- (5) How many messages are in your inbox?
- (6) Is this typical?
- (7) How many distribution lists do you subscribe to?
- (8) How often do you read your mail?
- (9) Do you read all of your mail?
- (10) What percentage of messages do you wish you had never seen?

B. A Subset of the Open-Ended Questions

- (1) Describe how you use mail.
- (2) In what categories do you place your mail messages?
- (3) Can you think of times in the past week in which you needed technical information? What did you do?
- (4) Can you think of times in the past month when you have looked at a previously filed message? Describe the procedure you used to find it.
- (5) What kinds of rules would you like to process your mail?

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