

More Than Just a Communication System: Diversity in the Use of Electronic Mail

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Abstract

This paper describes a series of interviews that focus on the ways that professional office workers use electronic mail to manage their daily work. A number of implications for the design of flexible mail systems are discussed.

Two principal claims are made. First, electronic mail is more than just a communication system. In addition to supporting information management, it provides a mechanism for supporting a variety of time management and task management activities. Some people are *prioritizers*, concentrating on the problem of managing incoming messages. Others are *archivers*, concentrating on how to archive information for subsequent use. Similarly, some people use mail to *delegate* tasks, while others *perform* tasks delegated to them by others electronically.

The second claim is that use of electronic mail is strikingly diverse, although not infinitely so. Individuals vary in their preferences, both in their general willingness to manage their work electronically and in their specific preferences along the dimensions described above. 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 and provide flexibility for a wide range of users.

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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 (Crawford, 1982) or enable the exchange of new information (Feld, 1986, Sproull, 1986). Electronic mail can also create new problems, most notably "information overload" (Denning, 1982, Malone et. al., 1987a, Hiltz, 1985). Sometimes there are both positive and negative effects, such as changes in organizational structure (Stasz & Bikson, 1986, Crowston, Malone & Lin, 1988).

What is the total effect of these changes and how does it affect the ways that individuals and groups perceive mail? 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 (Malone et. al., 1987b), 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 study describes a series of interviews that identifies existing patterns of mail use and desired improvements, both in terms of managing mail itself and in using mail to manage other activities. This analysis grew out of data from interviews prior to a study of the Information Lens.

The goal was to discover the ways in which people used mail to address problems. Exploring innovative uses of mail generated within a mature electronic mail environment may help us to better understand how to expand the capabilities of electronic communication systems to facilitate collaborative work.

Interviews

Members of a large research laboratory (approximately 60 people) within a major corporation were told about a study of the Information Lens. Individuals were asked to send electronic mail to the sponsors of the study if they were interested in participating. This paper describes 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 developed at MIT and designed primarily to help users filter and organize electronic mail (Malone et. al., 1987b). Lens uses semi-structured 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 will process 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 will fire if a particular message meets certain criteria. If another person creates such a message and addresses it to "anyone", the first user will receive it automatically.

The explanation of Lens caused people to critically examine their personal use of mail and served to focus attention on particular kinds of problems. Because Lens provided scenarios for solving these problems, people were able to apply these ideas to problems in their own work. Although individuals were attracted to different Lens features, the overall explanation of Lens provided a common ground for discussion.

Participants

The 18 individuals who were interviewed for this study included people with a broad range of jobs within the research laboratory. 15 were full-time researchers and 3 were managers. Of the researchers, 6 were computer scientists and 9 were trained in physics, psychology, anthropology, or sociology. An additional 5 people

were interviewed of those who chose not to use Lens, including 3 administrators, 1 computer scientist and 1 manager.

All of those interviewed are already experienced mail users working in an environment that has supported mail for over a decade. All rely on mail for formal and informal communication. Their existing mail system operates in a networked workstation environment. Users can create separate windows for composing, reading or browsing through messages or folders. The Lens prototype was designed to enhance rather than replace this system; users could choose any or none of the new Lens features, as desired.

Method

The first interviews were scheduled just after the general announcement of the Lens study. Several weeks later, Lens was demonstrated at an open meeting and individuals were again invited 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 includes one interview for some people and two interviews for others.

All interviews were scheduled for one hour in the participant's office. Everyone was asked to save the day's mail and delete confidential messages. The interviewer was able to examine the participant's mail messages, inbox and mail folders and used this information to check the user's perceptions of mail use.

After answering general questions about the Lens study, the interviewer asked a series of specific as well as open-ended questions. Users were asked to estimate their average numbers of messages sent and received, mail folders and distribution lists subscribed to. These answers were checked against the actual numbers and users were asked if the day was typical. Users 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.

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.

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, e.g., 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 and this quite frustrating for many of them.

From her perspective, electronic mail is an essential communication medium that 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's *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.

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, while others contain information that "may be useful someday", but can't 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've been acted upon and allow him to 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.

A Manager-Secretary Team

Ann is a manager who is responsible for a group of researchers. Unlike the previous users, mail is *not* used primarily 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 copy her on 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 automating this system, to avoid the redundancy of copying messages back and forth and to save them both time.

Analysis of the Cases

These three users exhibit a striking diversity in their patterns of mail use. Not only do they choose to process and organize mail differently, but they also think about the functions of mail in very different ways. Those who want help prioritizing incoming messages view mail as a time management tool. Those who want help archiving messages view it as an information management tool. Those who see it as a way to delegate tasks see it as a task management tool.

This level of diversity has been reported in other aspects of work, including different writing strategies using Notecards, (Trigg & Irish, 1987), different desk organization techniques (Malone, 1983), and different styles of information exchange (Allen, 1986). While these patterns of use are diverse, they are not infinitely so. Individuals tended to cluster in their views of mail and the kinds of problems it can address.

Diversity in Mail Use

Table One illustrates the patterns of mail use among those interviewed. Users estimated their mail use by examining a single day's mail and determining whether or not it was typical. They estimated average numbers of messages sent and received, average sizes of mail inboxes, and numbers of distribution lists. When a range was given, the midpoint of the range was chosen. The actual numbers of mail folders and distribution lists were also recorded.¹

Table Two lists the user's estimate of how often mail is read per day and a rating of the user's feelings of control over mail and the user's preferences for prioritizing or archiving mail.² The 18 users in the first three groups, researchers, computer scientists, and managers, all tried Lens. The 5 users in the last group, 3 administrators, a computer scientist, and a manager, did not try Lens.

Results

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 in this mail system can create mail folders in which to store mail messages. Here, the variability 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. Users with jobs that span more than one group or people interested in maintaining a large network of friends and colleagues are more likely to create large numbers 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 1350. Those with small inboxes often make a point of clearing them out on a regular basis. Note that small inboxes are not necessarily correlated 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. 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

¹The 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 non-work-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.

²Users were asked a number of other questions, including whether or not they read all of their mail, how difficult it is to find a message that has been filed, and how many steps it usually takes. In addition, users answered open-ended questions about their mail use. These have not been included in the table, but contributed to the interviewer's assessments of the user's feelings of control and whether they are prioritizers or archivers.

Table One

	Msgs Sent (Estimate)	Msgs Received (Estimate)	Mail Folders (Actual)	Msgs In Inbox (Estimate)	Distribution Lists (Estimate) (Actual)	
Managers:						
A	8	30	29	200	12	29
B	6	20	6	250	10	21
C		25	15	100	few	37
Computer Scientists:						
D	17	75	38	41	many	93
E	2	50	26	204	many	75
F	10	50	30	85	many	26
G	4	40	46	100	many	68
H	4	50	89	500	10	48
I	7	50	42	600	10	33
Other Researchers:						
J	6	30	29	7	36	52
K	6	35	63	450	10	41
L	10	50	49	600	20	85
M	4	12	8	15	10	19
N	5	35	12	80	15	22
O	10	35	23	15	10	51
P	10	50	20	450	30	36
Q	1	17	9	85	7	9
R	4	30	22	250	18	43
Non-Lens users:						
S	30	75	40	10	few	56
T	3	20	few	100	11	46
U	5	23	100	1350	10	68
V	3	35	11	1350	6	84
W	8	50	15		15	
Ranges:	(1-30)	(12-75)	(6-100)	(7-1350)	(6-36)	(9-93)

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 more willing to risk missing mail. All of the managers and administrators, most of the researchers (5/9) and one computer scientist are in this category. The remaining people feel that they subscribe to a moderate (and reasonable) number of distribution lists.

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 2-3 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.

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 fluctuations in 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. Correlations are not surprising among items that affect each other. For example, the number of distribution lists directly affects the volume of mail actually received. Other categories may be correlated because they result from the same cause. For example, people who do not like clutter may continuously delete messages from their inboxes and maintain a small number of folders.

Does the user manage mail or does mail manage the user?

These numbers only tell part of the story, though. If users' subjective views of mail are examined, an even greater diversity emerges. 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. What accounts for this disparity? This subheading describes the factors that influence these feelings of control and relates them to different strategies of work management.

Table Two lists the interviewer's subjective assessment of these feelings, based on comments made in the open-ended part of the interviews. Some people are quite content with mail and feel that they can use it successfully in their jobs. Others are "on the edge" and are barely able to handle their mail. ("I intend to read all my mail...someday!") Still others are 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.")

One indicator of control is how often the user chooses to read 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" messages as if it were a telephone call and 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't stop themselves from reading it anyway.

The size of the inbox also contributes to feelings of control. Those with very small inboxes are far less likely to feel overwhelmed than those with hundreds of messages. Most people treat the inbox as a 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 a while you get tired of all the junk"), while others are not ("it's worth it to have to delete 90% if 10% is interesting"). Another way to reduce

Table Two

Reading Rate Msgs per day (Estimate)	Prioritizer or Archiver	Feelings of Control
Constantly Once Intervals	Prioritizer Archiver Prioritizer	On the Edge OK OK
Constantly Constantly Intervals Constantly Constantly Intervals	Archiver Both Archiver Archiver Archiver	On the Edge On the Edge Overwhelmed OK Overwhelmed Overwhelmed
Once Constantly Constantly Constantly Intervals Intervals Intervals Constantly Constantly	Prioritizer Archiver Archiver Prioritizer Both Prioritizer Archiver Prioritizer Archiver	On the Edge On the Edge On the Edge OK Overwhelmed OK Overwhelmed OK Overwhelmed
Constantly Constantly Constantly Intervals Constantly	Prioritizer Neither Archiver Archiver Archiver	OK OK Overwhelmed On the Edge On the Edge

inboxes is to systematically delete messages after they've 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.

Individuals who feel overwhelmed by mail have some or all of the following characteristics. They:

1. Subscribe to many voluntary distribution lists.
2. Read mail at irregular intervals or constantly.
3. Try to read all of their mail, but don't always succeed.
4. Keep hundreds of messages in their inboxes.

5. Often don't get to the bottom of an inbox.
6. Want to save a large percentage of their mail.
7. Maintain many mail folders on diverse topics.
8. Have difficulty finding messages.

How can these differences in feelings of control over mail be accounted for? First, the role that mail plays in people's work must be reexamined. The conventional view, that mail is an information management system, is not sufficient here. Two other dimensions, time management and task management, must also be considered. If each is analyzed in turn, it becomes clearer why different people make the decisions they do to manage their electronic mail.

Some people who are overwhelmed with information can simply reduce the number of distribution lists they subscribe to. One researcher said "I get off as many distribution lists as possible; then I make friends with people who filter them!" 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 need *information management* tools that effectively identify and classify information.

Mail represents a time management issue for everyone. If the messages that appear in the inbox represent tasks to be done, the user must choose when to perform the tasks. Those who feel overwhelmed by mail are often reactive, allowing the order that the messages arrive to dictate the order that the tasks are performed. Individuals with jobs that require immediate responses, such as fixing broken equipment, are often in this category. Those who feel in control are more likely to actively prioritize their mail. A manager may be able to wait days before replying to most messages. Many of these users would benefit from *time management* tools that identify critical tasks and help prioritize them.

Task management is another important issue in feelings of control over mail. Some people receive a large number of work requests via mail and often feel overwhelmed because they have no one to delegate to and cannot refuse the requests. Those who feel in control are often those responsible for delegating tasks in the first place. Groups of users need *task management* tools that help identify who is most able to accomplish which tasks and assign them accordingly.

Dimensions of Work Management

I have argued that mail contributes to at least three different kinds of work: information management, time management and task management. Individuals in this study generally held one or two of these views of mail, but rarely all three. These views were revealed when I asked individuals what kinds of rules they would like to apply to their mail. The next three subheadings will describe these dimensions of work management in more detail and suggest how mail can successfully assist with each.

Time Management: Prioritizing New Mail

For some people, when the rules are applied is as important as the content of the rules. Those who want rules that run *before* they actually read their messages are **prioritizers**. They are interested in identifying important messages, based on any of a number of criteria, so that they can optimally sequence their work. These people are also very interested in rules that result in actions that do not require their intervention, such as automatically adding a meeting to an on-line calendar. They view successful time management as performing important tasks first and ignoring unimportant tasks.

Prioritizers display some or all of the following characteristics. They:

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.

Categorizing people as prioritizers has little to do with how successful they are at managing their time. Rather, it relates to whether or not they view time management as a salient issue in their current work. As discussed earlier, some prioritizers are quite successful and others are not, depending on their job responsibilities and strategies for managing mail.

Information Management: Archiving Old Mail

Other users are far more interested in applying rules *after* reading or skimming new messages. They can be classified as **archivers**. Their jobs often involve discovering, tracking and filtering large amounts of information. 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 sort 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. Archivers display some or all of the following characteristics. They:

1. Increase mail volume by subscribing to voluntary distribution lists.
2. Save a large percent of their mail messages.
3. Maintain a large number of mail folders.
4. Tend to read all of their mail, or try to.

Archivers are not simply packrats who are unwilling to delete information. They feel that they must view everything at least at a cursory level, because they must be aware of what is there. Some archivers 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. Other archivers are very disorganized and have a difficult time finding anything. These people probably need time management help as much as help with archiving.

Prioritizers and archivers are not mutually exclusive, although people in this study tended to have a preference for one or the other. An example of an individual who is both is someone who maintains a large network of colleagues and also tracks large quantities of information. Such people would like tools to both help them prioritize their correspondence and to manage their personal databases of messages.

Task Management: Requesters and Performers

Mail can be an efficient medium for delegating tasks. The burden of handling these tasks is often distributed disproportionately throughout the organization. Some people, particularly managers and high-level administrators, are more often **requesters** of tasks. Others, usually individual contributors and secretaries, are more often **performers** of tasks. High level researchers often fit in both categories, both receiving and delegating requests for action.

Requesters tend to feel less overwhelmed than performers for two reasons. First, they receive relatively fewer requests themselves and second, when they do

receive requests, they can often delegate them, accomplishing work through others. Performers may feel legitimately overwhelmed, especially if they cannot refuse requests and have no one to delegate to. High level technical people and research scientists often receive many requests because of their expertise, but because of their status, can choose which requests to accept. While they cannot necessarily delegate their work to others, as those in the first category can, they can refuse work or request assistance in a way that those in the second category cannot.

The ease of sending mail messages can increase the kinds of tasks that are assigned. From an economic point of view, it should not be surprising that the effect of lowering the cost of delegating tasks by mail increases the overall volume of mail. From the sender's perspective, the cost/benefit ratio is much improved. Senders receive the benefits of a delegated task at a lower cost. Unfortunately, this increases the burden on the recipients of these requests who must perform the tasks. The overall effect on the organization may be to improve group productivity. Even though individuals usually receive more messages than they send, because one message is sent to one or more recipients, the lowered cost of assigning tasks may increase the likelihood that a particular task is performed by the person best suited to doing it.

By this line of reasoning, groups will 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 will help them allocate tasks among themselves.

Implications for the Design of Electronic 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 (Von Hippel, 1986) 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 support different kinds of individual and group work. The use of rules to manage mail appears to be such a primitive, allowing users to modify the rules to meet their individual needs. It's clear that no single set of rules will be useful for everyone. However, mail systems that provide the general functionality of rules are likely to support a greater variety of work.

In this organization, mail is viewed as both part of the problem (it generates work) and part of the solution (it accomplishes work). Because the people who feel overwhelmed by mail use it for different purposes, different solutions must be identified for these users. The information management function needs an improved system of classifying messages. Semi-structured messages and artificial intelligence techniques for abstracting or analyzing messages may be very useful here.

The time management function needs better ways of identifying important messages and sequencing them. These often have less to do with the content of the messages and more to do with the current state of the user (e.g. "just back from vacation and facing 300 new messages" will result in different priorities than "just finished a big project and finally have time to relax".)

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.

Conclusions

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, called *requesters* and *performers*, 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 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. 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.

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Appendix

Participants were asked the following set 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've 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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