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Heavy Users of Electronic Mail

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A field study was conducted using a questionnaire and interviews concerning how electronic mail (E-mail) is used as a work tool for communication. The questionnaire, distributed electronically within a large organization, showed that employees sending and receiving large numbers of E-mail messages are not the same employees having problems handling E-mail. Managers seem to have problems to a larger extent than members of other workgroups. Interviews were then conducted with 10 employees selected by strata from the questionnaire study. Strata were based on the variables of job category, number of E-mail messages sent and received per day, and E-mail handling problems. The interviews showed that, although employees continually entered the E-mail program, they did not see this action as disruptive of other work activities; instead, they saw it as having a positive effect. E-mail handling problems correlated with the number of messages stored in the inbox (.72). Employees felt a shortage of time for handling E-mail and gave examples of communication problems. Regardless of the number of messages in the inbox and whether employees felt a time shortage, employees had difficulty organizing stored messages within folders and catalogues.

1. INTRODUCTION

This article focuses on electronic mail (E-mail) as a part of people's communicative and cognitive work environment. I present a field study involving a questionnaire and interviews concerning how E-mail is used as a work tool for communication within a large *high-tech organization* (a company using and constructing high-tech equipment). The user group in focus is *heavy users*—those using E-mail daily at work and sending and receiving large numbers of E-mail messages or using E-mail

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daily at work and having problems handling E-mail. The main issue in this study is the extent to which users have E-mail handling problems and how users deal with these problems in their communicative and cognitive work situation.

The theoretical background of this study is in cognitive psychology and information processing. Studying E-mail as a working tool, I believe that a laboratory setting that excludes certain aspects of communication represents too narrow an approach. Therefore, I carried out this study in real and natural settings at work and tried to include many aspects of communication.

Sections 1.1 and 1.2 summarize the communicative and cognitive aspects of handling E-mail that have been the subject of previous research. These sections also provide a framework for questions addressed in the user study presented later.

1.1. Communicative Aspects of Handling E-Mail

As a medium of communication, E-mail combines the advantages of both written and spoken communication. Lea (1991) found E-mail to be similar to written activities (e.g., note writing) in some dimensions and similar to face-to-face communication in other dimensions (e.g., spontaneity). Lea wrote that it is now widely held that computer-mediated communication is more appropriate for routine and "purely cognitive" tasks (e.g., exchanging information, asking task-related questions), whereas face-to-face communication and communication via telephone are more appropriate for the exchange of messages with more social and emotional content.

Range of expression in an E-mail message is narrower than in face-to-face communication, in which speakers can express themselves both verbally and by body language. According to Caldwell, Uang, and Taha (1995), the physical distance between communicators is one of three factors suggested to be involved in communication—the others being message content and message urgency. It is sometimes heard that E-mail is going to replace much person-to-person communication, but Safayeni, Lee, and Macgregor (1988) wrote that E-mail is not necessarily a threat to ordinary social contacts. They investigated two E-mail programs used within an organization. Positive and negative comments on the programs were collected. Nine percent of the users of one program and 15% of the users of the other program made negative comments concerning loss of personal contact; 78% of all the users made negative comments concerning technical problems; 23% of the users of one program felt that it was too expensive.

Using an E-mail program, a person can send a message to several persons at the same time. Distribution lists and computer conferences are more general facilities allowing several recipients to subscribe to messages on a certain topic. Compared to one-to-one E-mail communications, these one-to-many communications are time savers; however, they can lead to a large flow of messages to some individuals.

Sproull and Kiesler (1991) wrote that an unintended effect of widespread control of information is information overload. Hiltz and Turoff (1985) defined the notion of information overload—in the context of computer-mediated communica-

tion—to mean the delivery of too many messages (too many to respond to) and an increase in social density. According to Hiltz and Turoff, this may have the effect that the recipient fails to respond to certain inputs or responds less accurately or even incorrectly. Users may store inputs and then respond to them as time permits, or they may systematically ignore some features of the input and in some cases even leave the program completely.

According to Severinson Eklundh (1994) a "silence" in E-mail due to the lack of immediate feedback is the most salient feature that distinguishes E-mail from spoken media with respect to the conditions for dialogue. Severinson Eklundh discussed user aspects such as uncertainty and ambiguity. When a conversation ends in silence, it may, according to Severinson Eklundh, be taken by the user as a sign of a problem or a breakdown in dialogue. In the E-mail medium, there is a general uncertainty about when to expect or give feedback—uncertainty that may cause various disruptions in the communicative process. These problems are especially relevant when one of the participants is a heavy user of E-mail. In such a case, lack of response might simply be explained by the fact that the heavy user may not have had time to answer or may have simply forgotten the message. Another explanation is that the heavy user may have deliberately postponed a reply to await more information on the subject—a strategy common among heavy users who choose to economize on the number of messages. The message sender, however, may attribute the silence to some particular cause—the message did not arrive, the recipient was not planning to answer the message, the recipient may be dissatisfied with its content—on the basis of expectations derived from the norms of spoken communication.

In Severinson Eklundh and Macdonald's (1994) study of communication strategies, 51% of the users reported that, whenever possible, they read E-mail as it arrives. Mackay (1988) wrote, "Those who feel out of control are often those whose jobs do not require immediate response to E-mail but feel they can't stop themselves from reading it anyway" (p. 349). To enter an E-mail program as soon as a message arrives might be very time-consuming and might lead to interruption of other work. Bannon (1986) suggested that people feel obliged to answer a message as soon as it arrives.

In Section 1.2, I discuss some cognitive aspects of handling E-mail—the extent to which people are able to select, store, and retrieve stored messages.

1.2. Cognitive Aspects of Handling E-Mail

According to Waern and Waern (1984), people facing new situations and circumstances access prior knowledge and try to use it to handle the new situation. We can associate spontaneously, paste the new into a context, or initiate a more conscious search for prior knowledge that relates to the new. Prior knowledge can be transferred and so enable us to better understand and use the new, although, if the transfer does not fit the new situation, the prior knowledge will disrupt the new and become more of a hindrance than a help. Waern (1989) wrote that the best way to introduce a new computer program is to draw an analogy between the program and

some similar thing that is familiar to the user. Even when users have been given no explicit model, they will try to find an analogy they can use.

In a study of the implementation of office automation, Waern, Malmsten, Oestreicher, Hjalmarsson, and Gidlöf-Gunnarsson (1991) showed that users' experience and knowledge of an E-mail program were independent of their prior experience and knowledge of an E-mail program. This could have been due to the limited functionality in the two programs, which easily led to the development of a pocket of expert users. Nevertheless, users had problems describing the new program, and their descriptions would not have been of any help to novices trying to learn it. When the users themselves needed help, the most preferred and satisfactory way to get it was to ask another person.

The amount of information available is another influence. Hiltz and Turoff (1985) pointed out that there could be an optimal workload for phenomena such as communications. "Too-high" and "too-low" stimuli may lead to stress, and an overstimulated person will feel out of control. Hollnagel (1993) discussed control in the area of human–computer interaction and suggested that the degree of control felt may depend, for instance, on the amount of time available for the activity. Also, a user's work situation and message content (e.g., information only or a request to do something immediately or within a certain time) will influence the extent to which the user feels in control of the E-mail situation. The message received must often be handled in some way apart from being read or answered. Some messages are deliberately deleted or stored for later purposes.

Studies about how to select and sort information from incoming E-mail were performed by Malone, Grant, Turbak, Brobst, and Cohen (1987) and Mackay et al. (1989). Mackay et al. regarded the selection and storage of messages as filtering strategies of different kinds. Their study concerned the use of an E-mail program's customizable "rules" for automatically selecting messages for reading or automatic storage. The reading-and-storage filtering categories described are cognitive, social, and economic. According to Mackay et al.,

> Rules reflect the strategies users have for managing their inboxes. We found three primary strategies for handling E-mail boxes: Keep it all, move unimportant messages or move important messages. It is easier to write a rule than to get off a distribution list. (p. 5)

Using filtering rules is one way to prioritize messages before reading and to sort messages into folders for storage after they have been read. Delete-message rules are primarily used to erase messages of low priority (e.g., messages sent from distribution lists), not to erase private (personal) messages.

Mackay (1988) also studied patterns of E-mail use in terms of handling the E-mail itself. Three extreme-user categories were described—prioritizers, archivers, and managers/secretaries. Different filtering categories—ways to use or the intention to use rules for facilitating the use of the program—were discussed. The feeling of being overloaded with information seems to vary a great deal among people independent of the number of messages they send and receive. Mackay reported that one person felt 36 distribution lists were few, whereas another felt 20 lists were many. One person thought it was possible to feel in control with 75 mes-

sages per day, whereas another felt overloaded with 23. The users who felt overloaded, according to Mackay, subscribed to too many distribution lists, read E-mail irregularly or constantly, tried to read all messages, kept hundreds of messages in their inbox, saved a large percentage of their messages, kept too many folders, and had difficulty finding messages. Whittaker and Sidner (1996) reported similar results in their study of E-mail overload in Lotus Notes. They also found that E-mail is not used for communication only; it is part of other activities such as task management and personal archiving.

Mackay (1988) recommended that future research include the work situation and that, during design of E-mail programs, differences in use be highlighted (vs. trying to find a single, optimal solution for all users).

For some people, using filtering rules might be a good solution, but do we always know how to formulate the rules that benefit us most? The situation of the E-mail user is not static but dynamic. When filtering E-mail manually, we do not always choose the same key word, author, or length of message for reading or deletion. What we choose might depend on the work situation in which we find ourselves—that is, how much time we spend on E-mail and what is important for the work at the moment.

Jones, Bock, and Brassard (1990) described their field study as "motivated by a concern for developing a DEC window E-mail interface that would meet users' needs and be experienced as usable" (p. 46). They found that users had major problems organizing and retrieving information—problems independent of the program used: "Users felt overwhelmed by the amount of E-mail they received and were uncertain as to the structure of the organization [folders] they had created" (p. 46). Unfortunately, Jones et al.'s description of the structure of the organization created is far from complete, and it is not possible to form an understanding of the situation in which users of their E-mail program were studied.

Results from several experiments have shown that the ability to represent information visually is facilitated by grouping (e.g., structuring the information in a hierarchy or in an associative network). Representation, however, is not the only important factor involved in our understanding and remembering information.

These communicative and cognitive aspects are not meant to give a complete view of E-mail and how it is used but were selected to clarify the issues on which this study is focused.

2. METHOD

The main issue in this study is the extent to which users have problems handling E-mail and how they deal with these problems in their communicative and cognitive work situation.

A field study was conducted within a large high-tech organization. The background information presented here is part of the results obtained from the questionnaire and the interviews.

The work within the organization was organized mostly as projects. Employees' workloads fluctuated according to where in the project the work was

being done, but work was supposed to be completed during working hours (i.e., no overtime). Much of an employee's work was done at the office in front of a terminal. All employees had access to an E-mail program and were expected to use it during the day for communicating with other employees and customers and for distributing and receiving documents and information. Persons at the top of the organization used distribution lists to send information "downward" to all employees. This distribution of information depended on the recipients' positions within the organization.

All employees used Sun workstations, and the E-mail program most frequently used was Mailtool. Mailtool is a standard Open Windows interface to E-mail. It provides a menu-driven facility for reading, storing, composing, and sending E-mail. Scrollable windows allow access to the inbox and E-mail folders. Drag-and-drop is available between attachments and folders. MEMO, a menu-based E-mail program with conference possibilities, was used by some of the employees as a complementary program. Commands are issued via (mostly) one-character commands, and the program provides a worldwide address and telephone register of the whole company.

The empirical study was divided into two parts—an electronically distributed questionnaire and a series of interviews conducted with a stratified selection of 10 employees.

2.1. Questionnaire

The questionnaire included 24 questions and was estimated to take about 30 min to complete. It aimed to identify heavy users of E-mail, what problems users had handling E-mail, and whether these problems vary across work categories. The questionnaire was distributed electronically to eight workgroups within the company.

Participants

The 58 employees (53 men, 5 women) responding to the questionnaire were all highly educated. They had high workloads, used E-mail as a work tool daily, and belonged to the work categories of tester (12.1%), manager (29.3%), constructor (46.6%), and administrator (10.3%).

A tester tests printed circuit cards, software, and computer systems. A manager plans and coordinates the work in a workgroup and is involved in staff training, activity investigation, and alterations. A constructor's principal task is to develop software and hardware. An administrator works on a project's documentation and finance and performs system administration for a workgroup. The percentage of employees in each of these four work categories was estimated with the help of our informant at the company: 5.7% testers, 16.1% managers, 64.5% constructors, 12.3% administrators (1.4% of responses were missing) This distribution is higher for constructors and lower for testers, which can be explained by the fact that many of the responding constructors also had work tasks involving testing.

Amount of E-mail experience varied across participants from a couple of months to 13 years; most participants (60%) had used E-mail between 3 and 5 years.

Results

As E-mail handling can interrupt other tasks, I included the following question on the questionnaire:

How often do you enter your E-mail program?

( ) *Continually, I read the messages as they arrive*
( ) *Several times a day.*
( ) *At some occasion during the day.*
( ) *Several times a week.*
( ) *Once a week.*
( ) *More seldom.*
( ) *Other.*

The results revealed that most employees entered the E-mail program continually (37 employees) or several times a day (18 employees). Only 3 employees entered the program once a day.

Heavy Users Based on Number of Sent and Received E-Mail Messages.

The number of sent and received messages can help identify a heavy user and might also be an indication of problems handling E-mail. We asked the employees to estimate how many messages they sent and received each day. Eighty-five percent of the employees received 30 or fewer messages a day ($M = 15$); 75% sent 10 or fewer messages a day ($M = 6$).

On questions about estimating different message types (private messages, distribution lists), results showed that distribution lists dominated incoming E-mail and private messages dominated outgoing E-mail.

How much of the received E-mail was stored, and where was it stored? The mean number of messages stored in the inbox was 47 (range = 0 – 375); the mean number of messages stored within folders was 284. What is regarded as many or few depends, of course, on what is being compared. Given that 85% of the employees received 30 or fewer ($M = 15$) messages over the course of a couple of days, the number of messages stored in the inbox ($M = 47$) can be regarded as few; the number of messages stored within folders ($M = 284$) compared with the number of messages received over the course of 20 days must also be regarded as few.

The correlation between number of received messages and number of sent messages was .83, which shows that employees who sent a lot of messages also received a lot of messages. The third quartile of employees (i.e., the 25% sending and receiving the most messages) were classified as heavy users. The 18 employees who received 20 or more messages a day were included in this group, as were the

13 employees who sent 9 or more messages a day. Taking into account both sent and received messages, 10 employees were selected from the group of 31 and were regarded as heavy users for the purposes of the rest of this study.

These employees represent the work categories of constructor, administrator, and manager. Are the employees who send and receive a lot of E-mail also the respondents who have problems handling E-mail?

Heavy Users Based on E-Mail Problems. Using the questions presented here, we tried to find out if the employees had problems handling E-mail and if they had had such problems before.

How did you handle your E-mail today?

( ) *Handling my E-mail has never been a problem.*
( ) *I have some problems handling my E-mail but have not yet found a solution.*
( ) *I have had some problems handling my E-mail but have found strategies for resolving them.*
( ) *I feel I am on the border of being able to handle my E-mail.*
( ) *I feel I am on the border of not being able to handle my E-mail, although I have tried using some strategies.*
( ) *I cannot handle my E-mail.*

Of the 58 questionnaire respondents, 32 (55%) never had any problems handling E-mail, 15 (26%) had problems handling E-mail but had found strategies to resolve them, and 10 (18%) had problems handling E-mail but had not found a solution. We could not account for these results. Does the amount of E-mail have any connection with problems handling E-mail?

Correlating the variables of E-mail handling problems and number of E-mail messages sent and received per day revealed that only sent and received messages correlate (.83). The employees represented in Table 1 are not the same as the employees estimating themselves as having problems handling E-mail. Here we suggest that employees be viewed as heavy users from two points of view: They send and receive many E-mail messages, and they feel that they are having problems handling E-mail.

Can E-mail handling be different for different work categories? Table 1 shows, according to work category, how many employees selected each of the alternative answers to the question, "How did you handle your E-mail today?" More than half of the employees said that they did not have any problems handling E-mail. For testers, only minor problems occurred. Managers and constructors had the more severe problems.

We knew that some of the employees had problems, but what were or had been their problems? Employees who reported having problems handling E-mail were asked to specify what they were with regard to private E-mail and distribution lists.

Table 1: Four Work Categories and Employees' Answers Regarding Handling E-Mail

	Work Category			
Response Category	*Tester*	*Manager*	*Constructor*	*Administrator*
Handling my E-mail has never been a problem	3	2	19	6
I have some problems handling my E-mail but have not yet found a solution	1	1	3	0
I have had some problems handling my E-mail but have found strategies for resolving them	3	9	3	0
I feel I am on the border of being able to handle my E-mail	0	3	0	0
I feel I am on the border of not being able to handle my E-mail , although I have tried using some strategies	0	1	1	0
I cannot handle my E-mail	0	0	0	0
Missing	0	1	1	2
Total	7	17	27	6

Constructors' comments include: "The volume increases drastically. To read mail is one thing, to leave correct answers is another (which is not easier when the volume increases). This is more related to my work situation than to handling mail" (Employee 6), and "I think it is circumstantial to create mailboxes and folders, and it is circumstantial to move mail to those places, circumstantial to go to those places for storing and fetching mail" (Employee 56). Five managers reported that they were having problems handling E-mail: "They tend to be left in the inbox" (Employee 26), and "Here it is more common having to answer received mail, which can be hard to reach" (Employee 27).

A constructor described the problems with distribution lists:

> Here the problems are greater. The first problem is to find the important mail. The messages range from very important mail to totally uninteresting mail. It is hard to read all mail some days, and then it is easy to miss the important information. The second problem is to save messages in a structure, making it possible to find them again. (Employee 24)

Comments from managers using distribution lists include: "Too large quantity of information, I cannot manage" (Employee 2), "They tend to be left in the inbox" (Employee 26), "Sometimes I feel I have to unsubscribe to some distribution lists" (Employee 27), and "A lot of irrelevant information about babies getting born, about cakes, and so on. I need to save a lot of E-mail to be able to verify results of correspondence. This leads to enormous folders" (Employee 53).

Using folders in a structured way, which allows users to find stored messages later, can be difficult. For some constructors and managers, there was not enough time for handling E-mail, and this prevented them from reading all of their messages and allowed messages to accumulate in the inbox. This was also the case with distribution lists, but here the number of messages was much larger than the num-

ber of private messages—which is in line with the results for the number of sent and received private messages and messages from distribution lists.

Conclusion

Heavy users of E-mail exist and can be regarded as heavy from two perspectives. We know that both storing and retrieving messages can create problems, but we do not know how they are created.

Mackay's (1988) results suggest that the flow of information in and out of the inbox is experienced differently by different people (confirmed by the questionnaire results presented earlier here). All employees sending and receiving large numbers of messages were not having problems handling E-mail. Among the work categories, managers are the employees having problems.

Mackay described the characteristics of users having problems, but these characteristics do not totally agree with our results. In Mackay's study, a characteristic of users overloaded with E-mail was that they felt there was not enough time to read all their messages; this might have led to the effect that users stored a large number of messages in the inbox. In our study, the average number of messages stored in the inbox was 47 (the largest number of messages was 375). According to their comments, employees felt that retrieving stored messages was difficult. Also, the number of folders created for storing messages was experienced as a problem.

In two studies of organizations in electronic environments, Barreau and Nardi (1995) investigated how users store information on their DOS/Windows and Macintosh desktops. Users preferred storing information by location, as location functioned as a reminder and aided them when they were trying to find what they needed. Using location is not always possible in E-mail programs. Most E-mail programs do not allow users to use the workspace; information is more like a sequential presentation of messages.

Using only a questionnaire to perform a field study of an organization—and not having any insights into the nature and workings of the company—presents some limitations. Although such a study generates data from a realistic setting (users describing their work environment), not being able to visit users at their worksite leaves investigators with only a hint about how the work situation is experienced. Therefore, we decided to interview some of the questionnaire respondents. Our intention was to investigate them in more detail and to get a better understanding of their work situation.

2.2. Interview

We conducted semistructured interviews—and asked employees to give complementary demonstrations of the E-mail program being used—to investigate the following questions:

1. Was other work disrupted by continual accessing of the E-mail program?

2. Were norms and rules regarding response time used?
3. Were E-mail problems caused by too many messages in the inbox?
4. Did employees feel a time shortage handling E-mail?
5. Is there a pattern to how messages were stored within folders?
6. Were metaphors used to facilitate storage and retrieval of E-mail messages?

For each employee, the interview took place in his office and lasted about 1 hr. At the end of the interview, he was instructed to give a short demonstration of the E-mail program being used, its inbox, and the structure of the folders. During the demonstration, he was asked to think aloud. The interview and demonstration were tape-recorded.

Participants

Ten (male) employees were chosen from the questionnaire study. To get as broad as possible a view of the employees' work situation, we based the strata on variations in the variables of job category, number of E-mail messages sent and received per day, and E-mail handling problems. Table 2 presents the 10 selected employees' data according to these variables. All had used Mailtool for 3 years or more. One preferred using rmail, a program that could be used with Emacs, the employee's editing program. Even so, he used Mailtool as soon as an attachment was sent or received.

Five employees did not have any problems communicating with other people via E-mail. Employees who had problems mentioned that messages could be misunderstood. In the interviews, they explained that whether the text in the message will be spoken or written will depend on who the recipient is. E-mail sent to friends tends to be very informal and more like face-to-face communication.

Table 2: Employee Variables Used for Strata

		Number of E-Mail Messages Per Day		
Employee No.	*Job Category*	*Received*	*Sent*	*Problems Handling E-Mail?*
1	Manager	10	5	Yes
2	Manager	15	5	Yes
3	Constructor	12	1	No
4	Manager	30	7	No
5	Tester	7	25	No
6	Manager	10	5	Yes
7	Administrator	7	3	No
8	Manager	25	5	Yes
9	Manager	30	5	Yes
10	Constructor	7	1	Yes

Results

The results are presented following the order of the six questions presented earlier.

Was Other Work Disrupted by Continual Accessing of the E-Mail Program?

Only one employee (a manager) did not enter the program continually. When he was working in front of his terminal, he did not enter the E-mail program, even when the "E-mail-has-arrived" bell was ringing. He read the short messages and printed the others out on paper for reading on the way home or the next morning on the way back to the office.

The other employees accessed the E-mail program continually. They claimed that this was due either to curiosity (e.g., "Like when you get mail home in your mail box, then you run out and look at it immediately," (Employee 1) or to the expected arrival of important information. A spinoff effect was that these employees answered messages very quickly. Some benefits can be associated with accessing the E-mail program continually, but are there also disadvantages to doing this?

Seven of the employees felt they were being interrupted but experienced this as positive. Their comments include "It is like a micro pause. You get a break and are able to think about something else" (Employee 1), and "E-mail lets you send a message fast and you get the answer fast" (Employee 5). Two of the employees felt they were being interrupted but experienced this as necessary: "It is like the telephone. It also has a very high priority" (Employee 2). Only one of the employees expressed something negative: "It disrupts the concentration a bit when working with something" (Employee 6).

If work is important, E-mail must wait. These results are different from Mackay's (1988) results; there, users who felt out of control were often those who entered the program continually, even if their work did not require immediate responses to E-mail. These differences might be due to the policy of how E-mail is used at the workplace—that is, if it is good service to respond to E-mail quickly or if fast responses are not required.

Were Norms and Rules Regarding Response Time Used? There do not seem to be any explicit rules for response times in general. Examples of norms mentioned by employees are that E-mail from customers should be prioritized and answered within 24 hr. Also, reports on errors should be answered within a certain time. All employees said that they try to answer their E-mail all at once but some messages demand more of them—they must speak with other persons or get more information before they can answer—and so they need a couple of days or as many as several weeks. In these cases, two employees reply to the sender that they have received the message and are going to respond to it later. Most of the employees indicated that at least one message that had been sent to them went unanswered.

According to Kiesler, Siegel, and McGuire (1991), the availability of instantaneous electronic communication might lead people to expect immediate responses.

In our interviews, however, employees said that they receive answers in several ways. Some people answer very quickly (same day), whereas others need a reminder. Forty percent of the employees knew from whom getting answers would be difficult. Different strategies are used for getting answers. One strategy is to formulate the subject line in a way that attracts the recipient's attention. Some employees, using the "re:" command, include a message within a threaded dialogue. Messages sent can also be "carbon-copied" to a whole group of coworkers to put more pressure on the recipient. Other common strategies are to remind the recipient face to face or over the phone.

Receiving, reading, and responding are not the only activities handled in E-mail; some messages are stored. We wanted to make sure that employees' estimations of the number of E-mail messages stored in the inbox were accurate.

Were E-Mail Handling Problems Caused by Too Many Messages in the Inbox? The correlation between the subjectively estimated number of E-mail messages in the inbox with actual number there was .98. This is very high but might be explained by the fact that the study was taking place and that the employee was instructed by the systems manager not to burden the system by storing large numbers of messages in the inbox.

With our questionnaire and with Mackay (1988), results point to the fact that the flow of information into the inbox does not correlate with the problems users have. But, what about the amount of E-mail stored in the inbox? The correlation between the number of messages stored in the inbox and the problems handling E-mail was .72 (significant at .05). Bälter (1995) reported similar results independent of the E-mail program used. Users having problems seem to have more E-mail stored in the inbox than users not having problems. Why? Can it be due to too little time for handling E-mail?

Did Employees Feel a Time Shortage Handling E-Mail? Using E-mail can be seen as a "silent" or "invisible" work activity (i.e., others do not necessarily see how much time one person spends handling E-mail or if problems arise). The employees were asked to estimate how much time they spent handling E-mail during a workday. In Table 3, their estimations are divided into the three categories of low (<15 min/day), medium (16 to 30 min/day), and high (>30 min/day). They were also asked if this time was enough. Their answers appear in Table 3 along with their indications as to whether they had problems handling E-mail.

Of the seven employees spending more than 30 min a day on E-mail, only two employees thought the time was enough, and they did not have any problems handling E-mail. Employees 2, 3, 6, 8, and 9 had problems in general or problems specific to communication (i.e., answering, reading, being correct). Except for one constructor, all of the employees who had problems were managers, although one of the managers (Employee 1) used fewer than 15 min a day and felt it was enough. This indicates that time spent—with estimates of whether it is felt to be enough—might explain why some users have problems handling E-mail.

Table 3: Employees' Estimations of Time Spent Handling E-Mail, Their Feelings Regarding Adequacy of Time, and Their Answers Regarding E-Mail Handling Problems

Employee No.	*Job Category*	*Time Spent*[a]	*Enough Time?*	*Problems Handling E-Mail?*
1	Manager	Low	Yes	Yes
2	Manager	High	No	Yes
3	Constructor	High	No	No
4	Manager	High	Yes	No
5	Tester	High	Yes	No
6	Manager	High	No	Yes
7	Administrator	Medium	Yes	No
8	Manager	High	No	Yes
9	Manager	High	No	Yes
10	Constructor	Medium	Yes	No

[a]Low = <15 min/day, medium = 16 to 30 min/day, high = >30 min/day.

Employees who felt that E-mail time was enough did not have E-mail handling problems related to communication or to their work situation (examples of communicative problems that occur due to lack of E-mail time). Are the cognitive aspects of handling E-mail also affected by time?

Independent of how employees felt about their E-mail time, all except Employee 1 had problems using folders to organize stored messages. Employee 1 mostly used rmail, which forces the user to store all messages in one long list (the user can sort and search for the messages in several ways). Employee 1 thought that if he were able to store messages within folders, he would never read them. With rmail, he tried to keep his list as short as possible.

Everyone else had problems deciding where to store specific messages. Deciding which folder to store or retrieve a stored message in was a problem. Users might ask themselves, for example, "What about a message is most relevant, and, thus, where should it be stored—within a folder labeled with the sender's name or within a folder labeled with a topic?"

Setting out a structure for folders can be difficult to do initially. Many times, a structure emerges over time, unplanned. After a while, the thought may arise that the structure is not optimal and needs to be rearranged. No solution for this is available.

Three of the employees had changed the structure of their folders. The others explained that doing so would take too much time or be too difficult. Instead, they let the structure grow, and, eventually, the number of folders decreased (to be described in more detail). When storing a new message and no relevant folder was found, a new more suitable one was created.

The employees did not talk about these problems with one another, and only one of them got help from a colleague—help that solved the employee's problems handling E-mail. Rearranging a structure not only takes a lot of time but requires making several or many decisions about the depth and breadth of the structure. Some messages must be moved, and the problem of where to store them arises once again. Employees' comments include: "I do not have a good

structure. I am not pleased with it" (Employee 6), and "I have changed the structure, and it is quite bothersome. New folders have to be created, and E-mail has to be moved" (Employee 5).

To move or copy a message from the inbox to one of the folders, the user must mark the message, mark the folder (or specify it by name), and click on the "move" or "copy" button.

In Jones et al. (1990), users felt overwhelmed by the amount of incoming E-mail and were uncertain as to the structure of their folders. Employees in the study reported here, had problems organizing folders but did not feel overwhelmed by incoming E-mail. Together, the studies suggest that organization is itself a problem.

Is There a Pattern to How Messages Were Stored Within Folders? E-mail messages can be kept in the inbox (or printed on paper) as reminders to take action and/or reply. If these messages remain in the inbox, they might be lost amid the rest of the incoming messages, deleted by mistake, or stored in a folder where "once you find it, it is too late."

At the organization being studied, storing messages within folders and structuring the folders follow a consistent pattern. This is not because the employees found the same good ways of organizing their work; it is because the E-mail program controls these functions. Folders are listed alphabetically, messages are listed chronologically, and three different levels of items (i.e., catalogue, folder, message) are preset.

An employee could name and rename folders and sort messages within folders in several ways, but few used this functionality. Some did not even know it existed. Employees can also choose the number of levels in the structure. Eight of the employees used two levels of stored messages, and one used three levels (information regarding the last employee's levels is missing).

One of the employees who used a two-level structure (i.e., messages and folders) labeled his folders *Documents, Personnel (External), Personnel (Internal), Planning, Private, Projects, Progress Reports,* and *Protocols.* He explained that some labels are obvious, such as *Personnel (External)* and *Personnel (Internal);* that Documents did not function well; that Planning was a large folder (this employee was a manager, so planning was probably a large part of his job); that Progress Reports was easy; and that Protocols contained minutes of section meetings and minutes he had written.

Were Metaphors Used to Facilitate Storage and Retrieval of E-Mail Messages? If the employees related E-mail storage to something that is familiar to them, this might support their building a structure for their folders. They could, for instance, think of a bookshelf and how one might store books on it, or they could liken E-mail storage to storing information on paper in the office. These are two examples of metaphors, but are metaphors used?

We asked the employees, "Did you think of something in particular when you built your structure?" None of them had. This might be because the employees found it difficult to describe a metaphor on the spot during the interview. It might

also be because the E-mail program for the most part controlled the structure of the folders, leaving little up to the employee, and restricted spatial manipulation, which can facilitate memory.

From employees' descriptions of storing messages within folders, we know that metaphors were not involved and that there were problems building a structure of catalogues and folders. What strategies did the employees use to find stored messages?

"Find" and "sort" commands are available in Mailtool, and the "GREP" command (for finding stored information) is available in Unix (users can search only one folder at a time and must specify the folder).

The most frequently used strategy involved picking up a catalogue (or folder that seems to be relevant), browsing through the messages stored within it, and searching by keyword. Before beginning a search, four of the employees referred to the times on messages or the dates on folders to decide which folder was relevant. Only two of the employees used the find command. Employee 3's description of his search process shows why being able to use the program's find command is not a trivial matter: "It may be that I have to go through all the folders to find the message again." One strategy for facilitating E-mail handling could be to keep the number of messages very low, which could result in employees' gaining a better overview of their E-mail and retrieving messages more easily. This strategy would oblige employees to get into the habit of deleting messages.

Cleaning up their E-mail accounts (i.e., deleting unnecessary catalogues, folders, and messages) could make searching easier for employees (and free up computer memory). Four employees cleaned their accounts several times a year, two cleaned once a year, one cleaned several times a month, one never cleaned, and the data for two are missing.

The employee who never cleaned his account kept all of his E-mail. Most of the employees cleaned several times a year. Some did not clean regularly but only when their computers ran out of memory or their folders or messages became too old. Although empty or irrelevant folders could be deleted, the most common cleaning strategy was to delete single messages. According to the employees, the E-mail program could not clean automatically. One possible technical solution (suggested by Bälter, 1995) could be to let some of the stored information be automatically marked with a time-stamp indicating when it could be removed by the program. If employees were given this feature, they must be allowed to choose to use it and to be in full control of what was deleted and when.

Conclusion

As already mentioned, using E-mail can be seen as a silent or invisible work activity. The 10 employees interviewed used E-mail daily but did not discuss with colleagues their problems handling messages. The E-mail program was entered continually, but this was not felt to be disrupting other work.

No explicit rules existed regarding time limits for replying to incoming messages. Employees tried to answer messages quickly. Some messages demanded

more information and had to be answered later, although employees who did not answer messages quickly risked not answering them at all. Employees knew from whom getting answers would be difficult.

Employees who spent the most time using E-mail felt that the time was insufficient. All of the managers fell into this category, except for one who had stopped reading some of his distribution lists to be able to manage the rest of his E-mail. One solution for these employees could be to provide a feature that automatically sends replies like, "I have received your message and will answer it as soon as possible." Another solution could be to ask all users, when composing a message to be sent to more than one recipient, to express more clearly which recipient(s) will be expected to answer the message.

Employees explained that organizing stored messages was difficult. Even when not satisfied with the structure of their folders, employees were not willing to rearrange it, as doing so would take too much time. Giving new employees information and hints regarding structure and organization could help them handle their E-mail messages better.

3. DISCUSSION

At the company studied, employees were expected to use E-mail as a daily working tool and to use it following more or less implicit rules. E-mail handling cannot be studied in a laboratory setting but must be viewed in the context of a real work situation. At the employees' worksite, working hours were not calculated to include E-mail handling. Compared to other groups, some groups of employees (e.g., managers) seemed to have more problems handling E-mail.

In Sproull and Kiesler's (1991) field study, teams using E-mail did not communicate more (in total) than groups not using E-mail. The "E-mail group" spent less time in meetings and on the telephone. Sproull and Kiesler concluded that electronic communication need not increase the total time groups spend completing a project or affect the quality of the project. The time devoted to handling E-mail must be taken into account if some of the users' problems are to be solved.

It would be beneficial if to-be-mailed information were judged from the viewpoint of the organization. Some messages are appropriate for widespread E-mailing (to all employees); some should be targeted to specific groups or individuals; and others should be delivered by some method other than E-mail. In an example given by Sproull and Kiesler, sending an E-mail message to all employees at a worksite is a good idea. In the example, a car is burning in the parking lot, a person sends all other employees an E-mail asking them to move their cars, and the risk of the fire's spreading to other cars is minimized. Likewise, when a message is not urgent (e.g., one detailing the company priest's schedule that week), the information might not be of interest to all employees and should not be sent to all of them. Some information could perhaps be presented outside the E-mail program—for instance, in a newsletter, in a conference program, or on a bulletin board. As some employees are unaware of some of the features (e.g., find, sort) of the E-mail program, tutorials or courses could be arranged. Some of the problems

might be overcome just by encouraging employees to talk about them with their colleagues; sharing of experience and advice can go a long way.

Caldwell et al. (1995) pointed out that there might not be one solution that fits all and that the flexibility of technology-mediated communications could become an important issue in program design, adoption, and implementation. Communication is perhaps the most important aspect involved in the use of E-mail, but there is also a cognitive aspect that includes the work task and the handling of information. A combination of these communicative and cognitive aspects, if put into context, will give a more complete picture of the users' work situation.

Fulk, Schmitz, and Schwartz (1992) gave an example of research concerning group processes and the introduction of new technology. They pointed out that, without knowledge of the history of the variables measured enabling studying a process in change, no reasonable conclusions can be drawn regarding causal relations that express the need of longtime research.

The knowledge gained after performing this study is that E-mail is not to be regarded as static but as a dynamic process influenced by factors in the work context. For instance, workload fluctuates over time and can give very misleading results if data are collected at one time or only in an experiment. Workload also influences the time available for handling E-mail and the ways in which we can communicate with others. Using both a questionnaire and interviews, and conducting research over a longer period can be very valuable. As communicative and cognitive aspects of handling E-mail can be regarded as a process, several research investigations must be performed over time. Otherwise, we can never study how context and situation influence us in our daily work activities.

REFERENCES

Bälter, O. (1995). *Electronic mail from a user perspective: Problems and remedies* (Tech. Licensiale Rep. No. TRITA–NA–9510). Stockholm: Royal Institute of Technology, Department of Numerical Analysis and Computing Science.

Bannon, L. J. (1986). Computer mediated-communication. In D. Norman & S. Draper (Eds.), *User centred system design: New perspectives on human computer interaction* (pp. 433–452). London: Lawrence Erlbaum Associates, Inc.

Barreau, D., & Nardi, B. A. (1995). Finding and reminding: File organization from the desktop. *SIGCHI Bulletin, 27*(3), 39–43.

Caldwell, B. S., Uang, S.-T., & Taha, L. H. (1995). Appropriateness of communications media use in organisations: Situation requirements and media characteristics. *Behaviour and Information Technology, 14*(4), 199–207.

Fulk, J., Schmitz, J., & Schwartz, D. (1992). The dynamics of context–behaviour interactions in computer-mediated communication. In M. Lea (Ed.), *Contexts of computer-mediated communication* (pp. 7–29). New York: Harvester Wheatsheaf.

Hiltz, S. R., & Turoff, M. (1985). Structuring computer-mediated communication systems to avoid information overload. *Communications of the ACM, 28*, 680–689.

Hollnagel, E. (1993). *Human reliability analysis: Context and control.* New York: Academic.

Jones, S., Bock, G., & Brassard, A. (1990). Using electronic mail: Themes across three user interface paradigms. *SIGCHI Bulletin, 21*(3), 45–48.

Kiesler, S., Siegel, J., & McGuire, T. W. (1991). Social psychological aspects of computer mediated communication. In C. Dunlop & R. Kling (Eds.), *Computerisation and controversy* (pp. 330–349). San Diego, CA: Academic.

Lea, M. (1991). Rationalist assumptions in cross-media comparisons of computer-mediated communication. *Behaviour and Information Technology, 10,* 153–172.

Mackay, W. E. (1988, September). More than just a communication system: Diversity in the use of electronic letter. In I. Greif & L. Auchman (Eds.), *Proceedings of the Conference on Computer-Supported Cooperative Work (CSCW'88)* (pp. 344–353). Portland, OR: ACM Press.

Mackay, W. E., Malone, T. W., Crowston, K., Rao, R., Rosenblitt, D., & Card, S. K. (1989, April–May). How do experienced information lens users use rules? In K. Bice & C. Lewis (Eds.), *Proceedings of the ACM Conference on Human Factors in Computing Systems* (pp. 211–216). Austin, TX: ACM Press.

Malone, T. W., Grant, K. R., Turbak, F. A., Brobst, S. A., & Cohen, M. D. (1987). Intelligent information-sharing systems. *Communications of the ACM, 30,* 390–402.

Safayeni, F., Lee, E., & Macgregor, J. (1988). An empirical investigation of two electronic letter systems. *Behaviour and Information Technology, 7,* 361–372.

Severinson Eklundh, K. (1994). Electronic mail as a medium for dialogue. In L. van Waes, E. Woudstra, & P. van den Hoven (Eds.), *Functional communication quality: Ultrecht studies in language and communication* (Vol. 4, pp. 162–173). Amsterdam: Rodopi.

Severinson Eklundh, K., & Macdonald, C. (1994). The use of quoting to preserve context in electronic mail dialogues. *IEEE Transactions on Professional Communication, 37,* 197–202.

Sproull, L., & Kiesler, S. (1991). *Connections: New ways of working in the networked organization.* Cambridge, MA: MIT Press.

Waern, Y. (1989). *Cognitive aspects of computer supported tasks.* Chichester, England: Wiley.

Waern, Y., Malmsten, N., Oestreicher, L., Hjalmarsson, A., & Gidlöf-Gunnarsson, A. (1991). Office automation and users' need for support. *Behaviour and Information Technology, 10,* 501–514.

Waern, Y., & Waern, K.-G. (1984). *Tänkande pågår* [Thinking in progress]. Stockholm: Liber Förlag.

Whittaker, S., & Sidner, C. (1996, April). Email overload: Exploring personal information management of email. In *Proceedings of CHI'96* (pp. 276–283). Vancouver, Canada: ACM Press.