Electronic mail in a working context

Olle Bälter

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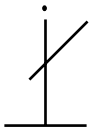

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Doctoral thesis

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Abstract

Electronic mail, email, is one of the most widespread computer applications today. While email in general is very popular among its users, there are also drawbacks with email usage: an increasing amount of messages that overwhelm users, systems that are too complex for naive users and at the same time do not support the needs of experienced users.

In order to answer the main research question “Which design solutions could improve the situation of individual email users in a working context when it comes to communication and handling large numbers of incoming and stored email messages?” three studies conducted in email users’ working environment are described. The studied organisations are one academic research laboratory, one technical company, and one primary medical service organisation. The studies are focused on email usage, organisation of email messages, novice versus experienced users’ needs, managers’ email usage, and information and communication overflow.

The results indicate that the different strategies used to handle email are a matter of a balance between advantages and disadvantages of these strategies. The choice between them is depending on the users’ total work situation and cannot be understood by investigating the email communication alone.

One advantage of email is the cognitive comfort it brings to its users by liberating them from thinking about tasks that can be solved by sending an email message, but this advantage disappears when the sender cannot trust that the receiver will act upon the message.

Users develop their handling of email with experience and work position. The media that managers use to handle the increased communication that follows with a higher position are email and meetings. One habit that do not change with position is to allow incoming messages to interrupt other work tasks, despite the asynchronous nature of email. This is particularly remarkable for managers who often complain that they need more uninterrupted time. The interruptions may partly be attributed to the lack of functionality in email systems to adapt the interfaces to the users’ work habits. In this case incoming messages result in a signal regardless the importance of them.

Email is a part of an information and communication flow. Some users have problems handling this flow. Overflow problems could be diminished by making senders of messages more aware of the receivers’ communicative situation. Email systems could provide feedback to senders of messages based on the receivers’ perception of his/her situation.

One of the studies indicates that it may be even more complicated to replace an old email system than introducing an email system for the first time in an organisation. The investment experienced users have made in the old system may be substantial.

A model of time usage for organisation of email messages is also presented in order to compare different strategies.

Several design solutions are suggested with respect to folder usage, sorting email messages into folders, reducing the number of stored messages, and tailoring the email system to the user’s work habits.

The thesis is written in English.

Keywords: electronic mail, user studies, interface design, field studies, information filtering, human information processing, non-technical users, managers, archiving, information retrieval.

Sammanfattning

Elektronisk post, epost, är en av de mest spridda datortillämpningarna idag. Epost är i allmänhet populärt bland användarna, men det finns också avigsidor: en ständigt ökande flod av meddelanden som översvämmar användarna och system som är för komplicerade för nybörjare samtidigt som de inte stödjer erfarna användares behov.

I denna avhandling presenteras tre studier utförda i epostanvändares arbetsmiljö. De studerade organisationerna är ett akademiskt forskningslaboratorium, ett tekniskt företag och en primärvårdsorganisation. Studierna är fokuserade på epostanvändning, speciellt med avseende på organisation av ebrev, skillnaderna mellan nybörjare och erfarna användare, chefers epostanvändning och informations- och kommunikationsöverflöd.

Resultaten indikerar att de olika strategier som används för att hantera epost är en fråga om balans mellan olika för- och nackdelar som dessa strategier har. Valet av strategi påverkas starkt av användarnas totala arbetssituation. En fördel med epost är att den kan reducera användarnas kognitiva belastning genom att befria dem från att komma ihåg uppgifter som kan hanteras genom att skicka ebrev, men fördelarna med detta försvinner när avsändaren inte kan lita på att meddelandet kommer att bli behandlat av mottagaren.

Användarna utvecklar sin hantering av epost med tiden, men det finns fortfarande otillräckligt stöd i epostverktygen för att verktygen ska kunna anpassa sig till användarnas situation. Medier för hantering av den ökade kommunikationen som följer på ett chefsskap är framförallt epost och möten. En vana som cheferna inte ändrar med stigande position i företaget är att de låter inkommande ebrev avbryta annan verksamhet. Detta är särskilt anmärkningsvärt för chefer som ofta önskar att de kunde få mer sammanhängande tid utan avbrott. Detta kan delvis förklaras av att det saknas funktionalitet i epostsystemen för anpassningar av systemen till användarnas arbetssätt. I detta fall resulterar alla inkommande ebrev i en signal, oavsett deras viktighetsgrad.

Epost är en del av ett informations- och kommunikationsflöde. För vissa användare blir detta flöde ett problem. Detta informations- och kommunikationsöverflöd skulle kunna minskas genom att mottagarna gör omgivningen medveten om deras kommunikativa situation, under förutsättning att de vill offentliggöra denna.

En av studierna indikerar att det kan vara mer komplicerat att ersätta ett gammalt epostsystem än att införa ett epostsystem där tidigare inget fanns, på grund av användarnas investeringar i tid och kunskap i det gamla systemet.

En modell för beräkning av tidsåtgång för att organisera ebrev i mappar presenteras för att kunna göra jämförelser mellan olika strategier.

Ett antal designförslag presenteras som stödjer eller underlättar mappanvändning, sortering av ebrev i mappar, reducering av antalet sparade ebrev, anpassning av epostsystem till användarnas arbetsrutiner och möjligheter att utforma personliga “ebrevpapper”.

Avhandlingen är skriven på engelska.

Nyckelord: elektronisk post, användarstudier, gränssnittsdesign, fältstudier, informationsfiltrering, mänsklig informationsbehandling, icke-tekniska användare, chefer, arkivering, informationssökning, modellering.

Acknowledgements

More than 250 respondents have been involved in the studies described in this thesis. They have answered surveys, participated in interviews, or filled in diaries. Some may not even know that they are participants. These are people in the studied organisations whom I have had lunch or coffee breaks with, participated in courses together with, or met when I followed other people around in their work. All these people have contributed with information that eventually has been forged into this thesis. I wish that I could thank them all by writing their names here, but I cannot even disclose the names of the organisations they work in. This is not fair!

The first person I may name is my supervisor professor Kerstin Severinson Eklundh who has guided me and my thesis through the uncharted seas of research, skilfully avoiding the sunken rocks of NoFunding, LackOfTime, and PleaseTeachOnMyCourse. Although I was initially opposed to some of her views, eventually I have come to the conclusion that she was right from the beginning. While she has never avoided criticising my work, she has always been there when I really needed her support.

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I would like to thank Yngve Sundblad, my supervisor for the first three years, for accepting me as a graduate student in the dawn of time. Although we have different views on the concept of time, I would like to express my appreciation of Yngve's social qualities and my admiration of his driving force of important events at Nada.

In the research group at the Interaction and Presentation Laboratory (IPLab) there are some people that have contributed to this thesis by direct work or by inspiring discussions on HCI, CSCW, or graduate studies. Kicki Groth has among other things helped me with categorisation of some of the material in the MainframePC study. Kai-Mikael Jää-Aro has solved many mysterious computer problems. Björn Eiderbäck and Per Hägglund taught me Smalltalk and contributed together with Lasse Kjelldahl to the development of CoMail. Kerstin Frenckner has made the administration of courses and master thesis projects simple. Ovidiu Sandor taught me Java and he has also made me feel very special by envying me all female visitors to our room and by receiving me in his home in Romania as a member of his family.

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Besides my supervisors, especially Kerstin, the more tricky spell and grammar checking have partly been made by Linda Kann, Eva Tofvesson, and Dr. Candy Sidner. If you are impressed by my vocabulary, thank them. To make the reading more interesting I would like to inform you that the remaining errors are made by me and if you find them and notify me before 17 December, 1998 you will be rewarded.

Not directly related to my thesis work but extremely important for all my work at the Royal Institute of Technology (KTH) are the members of the computer support staff at Nada (systemgruppen) that have kept all computers running and also Kalle Siklósi that paved the road for my return to KTH.

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My mental sanity has been heavily supported by the possibilities of structured insanity in Fysikalen, the group for student farce at the School of Engineering Physics. More than 400 people have been involved during the years that I have had the privilege to participate in Fysikalen, and it is impossible to mention all these fabulous people here, but I would like to especially thank Anna Redz, Gitte Ekdahl, Hedvig Sidenbladh, Mats & Jonna Löfdahl, and Maria Ögren for taking care of me in my darkest moments.

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I would also like to thank the guys I play floor hockey with for maintaining my physical health, but since I stepped on a stick and injured my back I cannot. However, my slipped disc has made me realise what wonderful friends and colleagues I have. You have all made it clear that I am richer than Bill Gates.

Finally I would like to thank my beloved Katarina for taking care of us by moving to Boston so that I could finish writing this thesis undisturbed:

Förnyelsebara värmekälla i Trälhavets vågor.
Ditt röda hår lockar fram mina bästa förmågor.
Min attraherande motpol
och skugga i Afrikas sol.
Tillsammans bildar vi epidemio- och dataloger.

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1 Introduction

The evolution of computers during the last decades has changed the industrialised parts of our world dramatically. While the computer originally was used only as a calculator, it now has evolved to a communications device that links people to each other and to information.

The most widespread computer application today used for person-to-person communication is electronic mail (email). Email facilitates communication by its high speed, asynchronousness, and computer processability (Palme 1995a), and provides opportunities to increase productivity, worker satisfaction, and organisational viability (Rice & Bair 1984; Safayeni, Lee & MacGregor 1988).

Among Internet users, email is considered as the most important application on the Internet (Katz & Aspden 1997). In Sweden the number of users connected to the Internet has doubled each year for several years (Sunet 1997). This growth involves new groups of users in the email community and this makes email usage and its impact on workplaces important to study.

The increase in the number of email users also increases the volume of email messages, both in circulation and stored on the receivers' computers. When the number of stored messages becomes large, overview of these messages becomes difficult as they no longer can be listed on a screen. These stored messages are for many users difficult to delete as they contain information necessary for their work, or are used as a to-do list (Whittaker & Sidner 1996). For some users, the amount time to handle incoming messages exceeds the available time. These users become overflown and important messages may be lost or forgotten in the flood of other messages (Hiltz & Turoff 1985; Mackay 1988). All this raises needs to reroute, organise, or delete messages.

It is important to find solutions for these overflown users without degrading the situation for those that do not have overflow problems. In other words, it is important to study many different types of users' email handling in order to identify problems for each user group; and for designers to solve these without causing more trouble for the other groups.

One group that deserves special attention when it comes to email usage is managers, whose ability to communicate efficiently are considered essential for their organisations (Alexander, Helm & Wilkins 1989; Hessner 1993). Managers have been reported both to use email frequently and to have more difficulties handling email than others (Markus 1994b; Lantz 1996; Whittaker & Sidner 1996).

These results come from studies of users' email habits and needs in work places. The insight to understand users' needs is shared among researchers and designers practising user centered system design. Norman & Draper (1986) expressed it:

> We wish to attempt User Centered System Design, to ask what the goals and needs of the users are, what tools they need, what kind of tasks they wish to perform, and what methods they prefer to use. We would like to start with users, and work from there (p 2).

Most research on email usage in workplaces has been performed, for natural reasons, on people that have a technical background or long experience of email usage. With

the increasing number of email users it also becomes important to study non-technical and unexperienced people's usage of email.

One of the difficulties with research in human-computer interaction is that the effect of a particular functionality in an application is affected by the context of which this functionality is a part (e.g. Norman & Draper 1986; Suchman 1987; Allwood 1991; Monk & Gilbert 1995; Brown & Duguid 1996). When it comes to email, this makes it essential to study users at work in the context of other communication and the different work tasks that these people have.

1.1 Research issues

This thesis describes three studies of email users at their workplaces, and a model of organisation of email messages. The general question handled is:

> Which design solutions could improve the situation of individual email users in a working context when it comes to communication and handling large numbers of incoming and stored email messages?

This question are refined into five main research issues described in detail below.

Email usage

We already know that email is fast, reduces the number of telephone calls, and provides possibilities for automatic documentation. On the other hand, research shows that the lack of social cues may make email unsuitable for certain types of communication. How and why do email users choose between the different types of media (fax, email, phone, meetings, paper mail) that they can use? When is email to prefer and when is it insufficient? What are the differences in usage between email and other media including meetings?

Information and communication overflow

A large number of incoming email messages may add to the information overflow that many users experience. However, overflown users in the studies by Markus (1994b), Lantz (1996), and Whittaker & Sidner (1996) still used email to handle a large part of the information flow. Are there aspects of the information flow that actually make email an important tool to handle it?

Lately, the concept of communication overflow has been suggested to replace the older concept information overflow (Ljungberg 1996). Research on managers establishes that communication is essential for them and that they spend 60-80% of their time communicating. This implies that managers may be exposed to communication overflow to a large extent. How does email affect this communication overflow?

Organisation of email messages

For many users who store email messages, organisation of these messages is essential in order to reduce problems with message overview, orientation, and management. What are the strategies that users develop for organising email messages? Are some strategies more effective than others? What are the design implications of the users'

problems with organisation of email messages? How can the interfaces of email systems be improved in order to simplify for the users to organise their messages in an effective way, according to their own personal choice?

Novice versus experienced users' needs

Novice users have different needs compared to experienced users and may therefore need other solutions to their problems with email systems. One objective of this thesis is to investigate these differences by following the development from novice to experienced user. Which are the strategies that novice users have chosen, deliberately or instinctively, to handle their email? Is there a natural evolution for the user between these strategies? Do email tools support the users' development from a novice to an expert when it comes to organisation of messages?

Managers' email usage

How can the email situation of managers be characterised and what can be done to improve it? Have managers learnt to use email to handle a part of their routine communication and social contacts, or is email only a duty adding to an already high workload? Are there possibilities of further developing systems of today to support managers in their struggle to handle the email flow?

1.2 Research background

Email provides possibilities for people to communicate via computers. Since users must learn to handle both distinctive features of email communication and interfaces to email programs, this research is a part of human-computer interaction (HCI). HCI is a multi-disciplinary research field and a part of the more general field of human-machine interaction (HMI). The Association for Computing Machinery's special interest group for HCI (ACM-SIGCHI 1992) defines the field as:

> Human-computer interaction is concerned with the joint performance of tasks by humans and machines; the structure of communication between human and machine; human capabilities to use machines (including learnability of interfaces); algorithms and programming of the interface itself; engineering concerns that arise in designing and building interfaces; the process of specification, design, and implementation of interfaces; and design trade-offs. Human-computer interaction thus has science, engineering, and design aspects (p 7).

Landauer (1997) divides HCI research into four categories:

- Evaluation or comparison of existing systems or features.
- Invention or design of new systems or features.
- Discovering and testing relevant scientific principles.
- Establishing guidelines and standards.

This thesis deals with the two first categories in Landauer's list by evaluating existing systems from the view of individual users in their working context in order to identify needs for new features.

Traditionally, HCI has examined relations between one human and one computer at a time. With the growth of computer networks the field has grown to include studies of groups that use computers to co-operate. Applications that support group work, *groupware* (e.g. telephone, fax, and email), differ from one-user applications. Groupware has no value for a user unless someone else uses it, and the value increases with the number of users that have access to it. In contrast, one-user applications such as word processing programs have a value for a single user although no-one else uses them, and the value does not increase significantly if more people have access to the same sort of application[1].

This part of HCI research that investigates how humans cooperate via computers is called computer supported cooperative work (CSCW). Lyytinen (1989) describes the area:

> CSCW is neither solely a tool or a technology business, nor just a new way to study computer impact on the work place. Instead, in CSCW, equal emphasis is put on the distinctive qualities of co-operative work processes, and on questions of design: how to mould computer technology to fit into and support these work processes. Due to the prominent role placed on the process of design, the issue in CSCW is not just how the work process is currently organised, but also how it could be organised (p 7).

CSCW-systems are designed to support communication, coordination, and collaboration between participants. Examples of applications are intranet information structures, calendar programs, and meeting scheduling support. These applications facilitate for geographically or time-zone separated participants to work together and find e.g. the minutes from the latest meeting or updated plans for a person's whereabouts. Real time communication can be supported by e.g. telephone or video conferencing tools.

It is important to include the working context in studies of CSCW-systems in order to understand why the participants act as they do. Galegher & Kraut (1990) write:

> Creating practical information technology requires not only technical expertise, but also an understanding of the social and behavioural processes that the technology is designed to support (p 1).

Email is the most used application for CSCW so far. This thesis examines email usage in the working context from the individual participants' perspective.

1. It is *convenient* to use e.g. a word processing application that is used by several others as it is possible to give files to others and use several different computers for document writing. However, it is not *necessary* that others also use the same application when a single user are writing a document.

1.3 Description of the studies

This section summarises the studied organisations and the methods used. The research issues described in 1.1 have been studied in three different organisations: one academic research laboratory, one technical company, and one primary medical service organisation.

Academic research laboratory

The academic research laboratory staff comprised researchers, graduate students, and some support staff, i.e. secretary and programmers, in total 32 people. They all used email daily and had used email for several years. The purpose of the study was to improve CoMail (Bälter 1995), an experimental email system. The study was based on a survey of all members of the laboratory and interviews with selected participants. Additional interviews were made with email users at some other sites to get a wider perspective of email usage.

Technical company

The technical company was in the computer business and had approximately 600 employees. The study was made at a time when the company planned to replace two mainframe based email systems with Lotus Notes. Three different methods were used in the study. Initially the group responsible for the introduction of Notes and some selected employees were interviewed. The main study was a survey sent to 116 randomly selected employees. Finally, three employees were followed for a year after the introduction of Notes in a longitudinal case study. These employees were interviewed twice. In between these interviews they completed diary protocols every other month to describe their communications during one day.

Primary medical service organisation

The studied primary medical service organisation is a part of a medical service district with approximately 5000 employees. The county council planned to provide all these employees with access to email before the turn of the century. The introduction was made top-down, starting with the management. Five primary care centre managers were followed for a year in the same way as the three employees in the longitudinal case study in the technical company. At the end of the study, a short questionnaire was distributed to all 138 employees at these five primary care centres regarding their writing frequency and computer usage and their attitudes towards computers in general.

Summary

The contribution from the different studies to the main research questions are summarised in table 1.1.

Table 1.1 Summary of contributions from the three empirical studies to the five main research questions.

	Academic research laboratory	Technical company	Medical service organisation
Email usage	X	X	X
Information and communication overflow		X	X
Organisation of email messages	X	X	X
Novice vs. experienced users			X
Managers' email usage		X	X

Besides the three empirical studies, a model of organisation of email messages is presented in order to make time comparisons between different strategies.

1.4 Outline of this thesis

Previous research related to the issues introduced above is described in the next chapter. Thereafter follows descriptions of the three empirical studies: the academic research laboratory in chapter 3, the technical company in chapter 4, and the medical service organisation in chapter 5. Each of these chapters is concluded with a short summary of the most important findings.

In chapter 6 a simple model for organisation of email messages is presented. This chapter differs from the empirical studies as it is a thought experiment of how time usage for organisation of email messages could be calculated in order to compare different strategies. The context that is important in the empirical studies is temporarily set aside.

In chapter 7, conclusions are drawn from the three empirical studies and the model. The conclusions consist of observations consistent across the studies and design suggestions that could diminish some of the problems discovered in the studies.

All parts of this thesis are my original work, with the exception of section 3.5 that reports work made in cooperation with Ann Lantz.

2 Related Research

This chapter reviews research related to the issues discussed in this thesis. There is a vast amount of research about email, and the parts described here only cover a few aspects of it. The chapter is divided into five sections. The first section describes a few basic concepts of human-computer interaction. The next section describes basic functionality of email and also gives examples of some interesting systems. Thereafter follows a section describing the differences between novice and experienced email and computer users and the next section describes email as a medium. The last section describes some different aspects of organisation of information and especially email messages.

2.1 Some basic concepts of human-computer interaction

In chapter 1 two fundamental aspects of HCI were described: the necessity of studying users and doing that in the context of their other tasks. This section describes two basic concepts necessary for the forthcoming discussions: classification of users, and adaptability.

Novice and experienced users

There are probably as many different ways to use email as there are email users and therefore it is too crude to speak about email users as if they were a homogeneous group. Here the groups *novice* and *experienced* users are defined. These categorisations are two extremes on a continuous scale where users with time move from novice to experienced. The terms novice and experienced are not self-explanatory and there are many other terms used in the literature: *parrot, naive, beginner, casual, infrequent, occasional, intermediate, advanced, experienced, master,* and *expert* (Fisher 1991; Koffler 1986).

While a parrot has learned nothing and only executes commands as told without understanding, naive, beginner, and novice are categories used for users that just have started to learn. The infrequent, casual, or occasional user has achieved knowledge but due to absence from the tool has to refresh his/her skills for a short period to perform at the achieved knowledge level again (Martin 1986; Trumbly 1988). Intermediate is a category between novice and experienced. Advanced, master and expert are other names used to describe experienced users.

Yet another category is the *discretionary* users defined by Santhanam & Wiedenbeck (1993). Discretionary users of computers are for example lawyers, executives, administrators, and professors. Typically, these users exercise only a small set of commands to accomplish most of their tasks. The Santhanam & Wiedenbeck study indicates that these users have expert-like characteristics on a small set of routine tasks, while their behaviour is novice-like when it comes to tasks outside these routines. The authors note that the discretionary users seem to settle with using the system in a limited way. These users' behaviour may be attributed to *cognitive laziness* (Allwood 1991), a tendency among humans in general to avoid cognitive effort, but also by

incomplete error messages that did not help the users to understand how the system worked.

In order to define the terms *naive*, *novice*, *experienced*, and *expert*, Fisher discusses, with an illustration from Spavold (1990), the differences between these terms. While novice and experienced are extreme values on a time scale, naive and expert are extreme values on a quality–task knowledge scale. These differences are illustrated in figure 2.1. With time, everybody may become experienced, but only those that develop task knowledge will become experts. Once you have become an expert you may still have to retrain due to absence from the task, as described above, or due to changing technology, especially in the computer business. This is also the definition used in the following chapters.

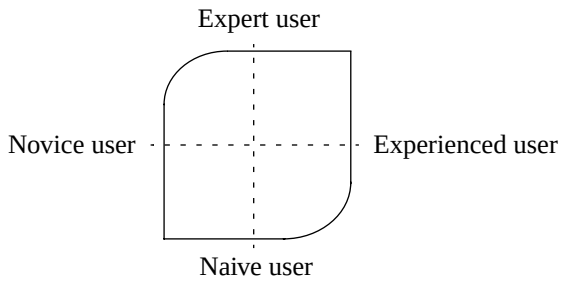


Figure 2.1 Two-dimensional conceptual space for user characteristics (from Fisher 1991). Novice and experienced are two extreme values on a time scale while naive and expert are extreme values on a knowledge scale. The rounded corners represent the impossibility to become an expert without experience and to remain a naive user with a large amount of experience.

Adaptability, adaptivity, and user adaptation

Both users and systems can adapt to each other. There are three terms related to adaptation that need to be defined: *passive adaptability*, *pro-active adaptivity*, and *user adaptation.*

Passive adaptability is when the program is user tailorable. An example is when the user can decide e.g. whether to use a Swedish or an English interface in an application.

Pro-active adaptivity is when the program itself adapts to the user (Dix, Finlay, Abowd & Beale 1993). For example, if a person constantly deletes all messages from a person without opening them, the email program could ask if it always should delete messages from that person. Such adaptivity is difficult both to develop and to handle for the user and must be implemented carefully. The adaptivity can be managed by “intelligent agents” (Maes 1993) that draw conclusions from the way the user handles messages and try “intelligent” guesses on how the user e.g. wants to have messages organised.

User adaptation is when the user of a system adapts his/her behaviour to the system. For example when a search function in an email system requires the user to specify which folder to search in, a user may adapt to the system by not using folders at all in order to simplify searches among all messages.

2.2 Email systems and design

The first part of this section describes basic functionality of email systems. Next follows a section describing some experimental systems with features that are not common in email systems today. The section after that describes filtering, a feature interesting for users that receive large amounts of electronic messages. Next follows sections describing four email systems that have received a lot of attention from researchers: COM, Information Lens, Messages, and Lotus Notes. Lotus Notes is of particular interest in this thesis as it was used in two of the studies (described in chapters 4 and 5).

Email functionality

An extensive description of electronic mail is given in Palme (1995a), where the technical, legal, and economical factors are described and analysed. For the purpose of this thesis a short definition of the terms used follows.

Email is a computer-based communication system where messages can be written by a sender on a computer. These messages are then transmitted via computers to the addressee's mail server where they can be opened and read by the receiver. Originally these messages could contain only text, but nowadays anything that is storable on a computer can be transmitted via email messages. In this thesis, messages that contain other information than text are considered as email messages with *attachments*. These attachments are normally files created with other programs (e.g. FrameMaker, Word, and Excel) than the email program. There are email systems that can handle information such as pictures, sound, and video without assistance from other applications, but this is not important for this thesis.

Email is distinguished from communication services such as *chat* or *talk* by its *asynchronous character.* Asynchronous refers to the possibilities for the sender and the receiver of a message to send and read the message at different times. Bowers & Churcher (1988) divided this time difference in to three parts: the time between message creation and the time of transmission (allowing the sender to edit the message), the time between the transmission and the receiver's opening of the message, and finally the time between opening and the responding to the message.

Asynchronous systems require the message to be stored on a computer. If the number of stored messages becomes large, many users prefer to group these messages into *folders*. The word folder is used in this thesis to describe a labelled container of email messages. In some systems, folders may also contain other folders. A folder can also be called directory, catalogue, or category. In most email systems only the content of one folder is visible at a time. To view the content of another folder this folder has to be manually selected. The folder where all incoming new messages are normally stored is in this thesis named *inbox*[1]. The inbox and the other mail folders are individual: each email user has his or her own folders and email messages cannot normally be read by others. The inbox is normally the only folder visible when a user starts an email system.

1. Another common name is mbox.

Electronic mail messages consist of two parts: A list of *headers* and a *body*. The body is used for the actual message. The headers consist of a *tag* and a *content* that define e.g. who the message should be sent to (the To-header with To: as the tag and the addressee(s) as the content) and the topic of the message (the Subject-header). Some of these headers are mandatory, but most are optional. Widely accepted in the Internet are the headers defined in RFC 822[1], but new headers can be added such as the headers defined in RFC 1800.

One mandatory header is the Subject, which is normally shown when the content of a mail folder is displayed on the screen. It is thereby often used for identifying the message. There are other headers in each message that are also used for identification by users, such as the name or the user id of the sender, and arrival time for the message.

All mail systems have functionality for replying to messages by issuing a reply command for a certain incoming message. This command normally automatically fills in the addressee field (with the sender address of the incoming message) and the subject field of the message (with the same subject as the incoming message). Often the subject content is preceded by a *Re:* to facilitate identifying the message as a reply.

When new headers are added, there will be mail tools that cannot interpret these new headers, but in experimental email systems this can be used to add new functionalities. Headers can for example be used to confirm delivery of messages. There are systems that have possibilities of delivery confirmation, e.g. COM (see section 2.2.5), Memo, and Lotus Notes (see section 2.2.8).

Email users also need to store email addresses of other users. These addresses can often also be stored in an address book in the email tool. Normally it is possible to define short-cuts in the email address book, in order to send the same message to several receivers at the same time by using the short-cut name only.

There are in many cases a thin line between email systems and computer conferencing systems that also handle written asynchronous messages. This thin line is also bridged, or blurred, by some systems that integrate the handling of addressed email messages, distribution lists, and conferencing systems such as COM. The difference between email and pure conferencing systems is that email messages are directed to named addressees, while messages posted in conferencing systems can be read by anyone (anyone with access to the conference during the period the message is posted). In email distribution lists, only those that are members of the list at the time of sending the message will receive a (first hand) copy.

Nowadays several email systems have been extended to *groupware* systems for collaboration that are integrated with databases, word processors, drawing tools and spreadsheets. Groupware can be defined as: “software designed to be used by more than one person, for instance networking and electronic mail software” (Preece, Rogers, Sharp, Benyon, Holland & Carey 1994).

1. Request for comments. In the Internet community suggestions for new standards are posted as a request for comments. Internet users may then comment these before they are accepted as an Internet standard. RFC 825 describes how this should be done.

2.2.1 Email history

In the late 1960s the first electronic mail systems made it possible to send messages to other users on the same computer. In the 1970s many computers in the United States became connected by a network called ARPAnet[1]. Email soon became one of the most used applications and definitions of common headers became necessary (Palme 1995a). Mail headers have been in use in other communication for a long time. Yates (1989, pp 216 & 239) describes examples of usage of the headers *From*, *Subject*, *To*, *arrival date*, and *reply date* as early as in the 1880s on stationary used at the chemical company Du Pont in Delaware.

One hundred years later local area networks (LANs) made it possible to develop email systems for use within these LANs. During the last decade LANs, and wide area networks (WANs) have been connected to form the Internet.

Two views of the evolution of email systems follow: a user's and a technical point of view.

Pliskin (1989) gave a description of the advantages "a wonderful dream come true; to be in touch, daily and for free, with dear colleagues" and problems of email. She reported her own experience and described the following problems with email:

1. Addressing difficulties
   When communicating with people outside the home site there are often problems with finding their addresses. A similar function to the phone message "The number has changed, the new number is #" would mean a lot.
2. Unreliability issues
   There is no possibility to know whether a message has reached its destination or not, until the addressee responds to it.
3. Medium limitations
   It is impossible to send anything but plain text and there are no possibilities to send a signature (e.g. on a contract).
4. Interface problems
   Users often have to retrain when their mail box is transferred to another combination of host computer and network.

Pliskin's list of desirable improvements included: simplification of address codes, automated address directory compilation, interfacing to other media and automatic message tracing.

Since Pliskin's study was made a decade has passed and the problems she described have been solved. There are still no *complete* catalogues of email addresses, or no service for handling changed addresses, but attempts have been made to make Internet information more structured with WHOIS++ (Deutsch, Shoultz, Fältström & Weider 1995), and the World Wide Web has also increased the possibilities to find email addresses. Headers are defined to enable for the receiving email system to issue "confirmation of reception messages", but the functionality to handle this is still missing in most email systems (Palme 1998). Messages with other content than plain text are possible to send today with MIME – Multipurpose Internet Mail Extension (Borenstein &

1. ARPA = Advanced Research Projects Agency.

Freed 1992) that defines how messages containing e.g. formatted text, audio, images, and video should be interpreted. Retraining is limited for those users that transfer between different graphical direct-manipulative email systems. Users that transfer to or from command-based systems still have the same retraining problem as Pliskin described in 1989, but the number of users with such systems are diminishing.

There are other issues that have not been solved, despite the fact that a decade has passed. In a study of the COM system (see section 2.2.5) Severinson Eklundh (1986) describes the need for handling email dialogues. Email messages are often sent as a part of a dialogue. In her study 49% of the responses were sent within two minutes from reception of the message and 95% within an hour. COM provided possibilities to follow dialogue threads by accessing previous messages, which was fairly simple, and in her study many users regularly reviewed previous messages in dialogues to grasp the discourse context while reading. In a recent paper, Severinson Eklundh (1996) discusses the same need for a context to email dialogues. This is often achieved today by including the previous message in a reply, but if a user wishes to read several previous messages in a dialogue, these messages have to be searched for manually.

National characters

The problem of distorted national characters is important outside the English speaking community. The A-Z alphabet works perfectly well in English-speaking communities, but almost all other languages have specific letters which are as important as A-Z. In some cases the differences are small and can be solved with e.g. accents, but in some cases similar letters have different sorting order (e.g. in Swedish the letter Ö is the last in the alphabet). The lack of certain letters can be compared to removing a letter from the English alphabet when using email. In Swedish the problem is particular great with the letters å, ä and ö. A short description of common reasons for this follows.

Most computers today base their data on eight-bit units, called octets or bytes. One bit represents zero or one. An eight-bit-byte can represent 256 different characters. However, historically, normally only seven of the bits were used for storing character data. Also, the computer software development was mostly done in USA, where the characters A-Z often are sufficient. This caused implementing of protocols for email handling in Internet under the assumption of use of the seven-bit coded character set ASCII, which contains only the letters A-Z.

In the 1980s, several 8-bit coded character sets – some vendor-specific and other internationally standardised – were beginning to be widely used, e.g. in Europe. When such a coded character set is used together with email handling software, written according to the seven-bit specifications in the Internet standards, there is obviously a great risk of malfunction. One common example is data distortion due to zeroing of the eighth bit, see figure 2.2. Technically, the problem is already solved, through rewriting of Internet standards, but it will take time before all software has been adjusted to the new specifications.

Original string:	abåäö...
As octets with the coded character set ISO Latin 1, decimal:	97 98 229 228 246...
As binary numbers:	01100001 01100010 11100101 11100100 11110110...
After distortion - most significant bit zeroed:	01100001 01100010 01100101 01100100 01110110...
In decimal:	97 98 101 100 118...
Corresponding ISO-Latin 1 string:	abedv...

Figure 2.2 Data distortion of eight bit characters.

A related problem is usage of different coded character sets in different computer environments. E.g. the character Ö (a frequent letter in Swedish, but also in e.g. German, Hungarian, and Turkish text) is in Sweden coded as the octet values 92, 133, 153, or 214, depending on the coded character set used. These problems can be handled for most languages by international standards, such as Unicode (Unicode 1991, 1992, 1993). For the eight languages and alphabets in the five Nordic countries, see Nordic (1992).

When email messages are sent to another computer, the result may be that these characters are displayed as another character at the receiver. E.g. an 'Ö' sent as 92 will be displayed as '\' at the receiver. The octets arrive undistorted, but the receiving computer interprets them in the wrong way. The solution for email is MIME (Borenstein & Freed 1992) that allows the sending system to define how the receiving system should interpret these characters.

2.2.2 Email interface design

In order to understand the discussions about interfaces and design that follows, definitions must be made of *feedback* and *direct manipulation*.

Feedback can be defined as "sending back to the user information about what action has actually been done [and] what result had been accomplished" (Norman 1988). Feedback is important so that the user always knows what the computer is doing (Dix, Finlay, Abowd & Beale 1993). Feedback can be divided into three different types where information shows that:

1. The computer has understood the user's instruction.
2. The instruction has been executed and how.
3. The execution may take time.

An example is adding an attachment to an email message. There should be a (visual) difference between an email message with an attachment and a message without.

Direct manipulation can be defined as "a communication style in which objects are represented on the computer screen, and can be manipulated by the users in ways analogous to how the user would manipulate the real object" (Preece et al. 1994). According to Dix et al. (1993) a part of the success of direct manipulation interfaces lies in their ability to constrain user interaction to actions which are both syntactically correct and correspond to the intended user tasks. Therefore, the probability of errors decreases.

The term was coined by Shneiderman. He claimed that direct manipulative systems

would be better for users than command-based systems and gave several reasons for this (Shneiderman 1982):

1. Novices can learn basic functionality quickly, usually through a demonstration by a more experienced user.
2. Experts can work extremely rapidly to carry out a wide range of tasks, even defining new functions and features.
3. Knowledge intermittent users can retrain operational concepts.
4. Error messages are rarely needed.
5. Users can see immediately if their actions are furthering their goals, and if not, they can simply change the direction of their activity.
6. Users have reduced anxiety because the system is comprehensible and actions are easily reversible.

Direct manipulation requires incremental action on visible objects in the interface with a rapid feedback. When designing a direct manipulative system traditional text commands are replaced with actions to manipulate visible objects directly. Most actions should be possible to reverse, every user action should be a legal operation and not result in error messages (Shneiderman 1983).

An example is moving a message from one folder to another by grabbing the message, dragging it to the other folder, and dropping it into the folder. The message and the folder are visible objects (represented by icons). When the message is selected the interface gives feedback, e.g. by changing the cursor to the message's icon. During the movement from the original position to the new folder, the message's icon is visible on the screen and moved rapidly in small steps. If the user regrets the action it is possible to move the message's icon back to the original position. If the movement is completed to the new folder, the folder icon responds in some way (e.g. by engulfing the message's icon).

Direct manipulation can be contrasted with an example of command language usage to move a message to a folder. A command language operation can consist of writing a command specifying that a message should be moved, which message(s) to move, and the target destination. In the Unix mail handler MH this can be done by the command:

```
refile 4711 +DogbartRules
```

Where `refile` is the command, `4711` is the number of the message to move and `DogbartRules` is the name of the target folder. The plus sign is a switch that identifies for the refile command that the item following the plus sign is a folder name. This action is not possible to reverse in a simple way[1] and any misspelling is an illegal operation.

Many interfaces use a combination of direct manipulation, menus, and command

1. The moved message 4711 will get a new number in the new folder and the user must issue a command (scan +DogbartRules) to view the new folder and identify the new number (e.g. 17) of the message. After that the reverse move can be made (refile 17 +orignalFolder), but if there were messages with higher number than 4711 in the original folder, the message will once again get a new number.

language. E.g. the user is allowed to select the message (direct), and then choose a command from a menu (menu). This results in a dialogue window where the user should write (command) or select in a list (menu) the name of the target folder.

Benbasat and Todd (1993) have done an experiment which compared a direct manipulation interface with a menu-based interface using an electronic mail system. The subjects were introduced to the system and then performed a task twice in succession. After a week they performed the task a third time. Subjects working with direct manipulation interfaces completed their tasks faster than those with menu based interfaces. However, this difference in time was not significant when the task was repeated a third time, indicating that the benefits to direct manipulation might diminish after a learning period. No interface was better than the other in terms of reducing error rates when interacting with the computer system.

Ankrah, Frohlich & Gilbert (1990) made an experimental study where they examined the relation between direct manipulation and metaphors. Although they found direct manipulation of value to reduce errors, learning time, and performance time, they concluded that the concept of *directness* is more important, as described by Hutchins, Hollan & Norman (1986). The latter divided directness into *semantic* and *articulatory* directness.

Semantic directness exists if it is possible to express what one wants to say in a particular language and if this can be done concisely. This regards both formulating the user's intentions with the system and evaluating the status of the system. An example is a user that would like to send a document to another user. Semantic directness in that case would be a possibility to send an attachment with an email message. The semantic directness would be less in a system that does not handle attachments.

Articulatory directness exists if the way in which an action is performed mimics the user's intentions. An example of articulatory directness in an email system is how attachments should be included in a system. An articulatory direct way is to select the document on the desktop (assuming an operating system with a desktop metaphor) and dragging it to the email message. A less direct way of doing the same thing is to select a command in a menu in order to use a dialogue window to attach the document to the email message. In order to interpret the status of the system, the system should give feedback to the user that the message contains an attachment.

2.2.3 Filtering

Filtering is a process where rules are defined for how to prioritise, sort and delete messages. Filtering rules can be applied both to sort incoming messages in different folders – before or after they are read – and to re-sort messages stored in folders.

A possible problem with filtering is that the filtering rules have to be defined in some way, which may be simple for programmers, but not for ordinary users. Jeffries and Rosenberg (1987) suggest a form-based language to handle filtering of electronic mail. They studied 18 users and found that with their form-based language, non-programmers could produce filtering instructions at the same speed as programmers could do with a procedural language. Programmers using the form-based language were even faster.

Studies by Mackay, Malone, Crowston, Rao, Rosenblitt & Card (1989) of the Information Lens system (see section 2.2.6) showed that users without significant computer experience could define filtering rules and use them, even without the templates provided in the system for constructing rules. Rules were used both to prioritise messages before reading them and to sort them afterwards. Delete rules were primarily used to filter out messages from low-priority distribution lists, but not to filter out personally addressed messages.

For some of the users these filtering possibilities were of great value. Mackay et al. quote an interview with a user: “These two [filtering] rules changed my life!”. However, many of the users did not find the system of use in their working environment. (Mackay 1990).

Davis & McManus (1995) suggested that the problem with information overload could be decreased by using filters to categorise incoming messages and then access them later using an open hypermedia system to provide multiple methods of access.

Automatic filtering

Another way to avoid programming for the users is to design the filtering system in such a way that the system can learn from the user how to sort messages. Losee (1989) developed a formal model based on economical and statistical decision theory to rank messages on a scale of interest. The model assumes that each message contains certain features such as author, origination time, subject, keywords, category, and recipients of the message. The user provides feedback by classifying messages as relevant or non-relevant. The features and the feedback are used in a Bayesian artificial neural network that considers prior and new knowledge in order to provide the user with a more accurate ranking in the future.

A similar suggestion has been made by Shet & Maes (1993) and Maes (1993), who propose intelligent agents that learn from users by training, imitating users’ actions, and receiving negative feedback when it takes the wrong actions. These agents work as a complement to user defined filtering rules. Another example of intelligent filtering is described in the IntFilter project (Kilander, Fåhræus, & Palme 1997a). Palme, Karlgren & Pargman (1994) discuss design issues for filtering systems that appeared during the work with the Private Filtering News Agent (Kilander, Fåhræus, & Palme 1997b) in the IntFilter project.

Problems with filtering

However, filtering is not always useful. Malone, Grant, Turbak, Brobst & Cohen (1987) report problems with *excessive filtering*: the rules can be used to filter out messages that are personally addressed, users of such a rule could become less responsive to information from other people in the organisation; *imperfect finding*: some messages may be filtered away from users because the users would not know that they wanted to read these messages before they actually had seen them; and *conflicts of interest*: an advertiser that has a message that most people would filter out may send messages with a popular subject line to trick people to read them. The authors argue that these problems exist even without a filtering system, and that filtering actually could reduce most of these problems.

Fåhræus (1997) made a user study where three users experimented with a prototype of the IntFilter system. Her conclusion was that the respondents found filtering of limited use.

During the development of Messages (see 2.2.7) a help system *Advisor* was built upon the features in the Andrew Messaging System to handle questions from users about the system itself. An attempt was made to use a filter to automatically redirect these messages to the persons responsible for different categories (for example “mail” for those that only answered questions about mail). However, the filtering was not successful. More than 50% of the messages ended up in the miscellaneous category, as unsortable, because most users did not specify the problem enough in the subject line and often wrote e.g. “Help!”. The computerised filtering was therefore replaced by humans. All help questions were directed to a group of students that only answered simple questions and forwarded all other questions to a person they knew would know the answer (Borenstein and Thyberg 1991).

2.2.4 Experimental email systems

This section describes some experimental email systems with interesting features. There is research on both what can be done with the existing email headers (e.g. those in RFC 822) and how these headers can be extended to support new functionality.

An idea is *computational email* (Anderson & Gillogly 1976), email messages with embedded programs. When the message is opened, the program is started. This embedded program could for example be used to ask receivers about suitable times for a meeting in a structured multiple choice question, and then automatically return the message to a server collecting the answers from other recipients to find a meeting time. This interactive mail is interesting, but since these interactive messages have many similarities with computer viruses[1], the security problems are severe.

Borenstein (1992) discusses these advantages of building CSCW applications on top of email and the security problems with embedded programs in email. Borenstein’s solution to the security problem is *ATOMICMAIL*, a LISP-based language with all possible security leaks removed. Today, the World Wide Web can be used for similar tasks by e.g. sending an email message with a URL[2] in it. This URL can be used by the receiver to start a Web-browser. Functionality for this is provided by several email systems today.

Goldberg, Safran and Shapiro (1992) write “when electronic mail is used for computer-mediated conversation, users often find it hard to maintain dialogue continuity”. Their solution is *Active Mail*, a system that uses email to distribute interactive messages. The system supports interactions between sender, receiver and future participants with e.g. functionality similar to a shared editor with commenting support and a meeting scheduler that allows the participants to negotiate about appointments without necessarily filling in a on-line calendar.

Structured responses to email messages are also discussed in Camino, Milewski,

1. Computer viruses are also programs that (often) originate from outside the receivers’ system and start executing on the receivers’ computers out of control of the receivers.
2. Uniform Resource Locator, an addressing system used for Web-pages.

Millen & Smith (1998). They did not construct an experimental system, but they analysed the content of 100 outgoing messages for eight email users and concluded that between 30% and 50% of these 800 outgoing messages could be handled by structured responses.

Cockburn and Thimbleby (1992) report about the Mona system that presents a remedy to the problem with tracking dialogues. Mona uses the header information in RFC 822 format to establish two paired link types with each message:

- previous and next message by the same user,
- the inferred cause(s) and response(s) of a message.

The relationship between previous and next message is based on the time of sending. The cause and response is based on the arrival time of a message to a group of recipients (a similar relation can be based on the contents of Subject field and Re:). If a message m1 sent from person A is received by person B before B sends message m2 to A, then m1 is considered the cause of m2. This information is used in Mona to build a web of the conversation structure that can be displayed graphically.

The speed of email makes it possible to handle also synchronous information exchange with email. This is, however, an example of usage of email for other purposes that it was designed for. Whittaker, Swanson, Kucan & Sidner (1997) noted this and defined five features important for a communication system to support what they call lightweight interaction that frequently occurs in workplaces:

1. Conversational threading
   All parts of the same dialogue should be possible to access as a unit.
2. One-way-drop
   It should be possible to leave brief messages without waiting for the recipient to answer.
3. Quick connections
   The system should support rapid flexible (e.g. different media) synchronous communication connections with co-workers.
4. Context preservation and regeneration
   Besides handling the dialogues as a unit, it should be possible to include other material such as documents in the same unit as the dialogue in order to provide more cues to the context.
5. Shared objects
   The system should support real-time shared objects.

Email can be used to handle a part of this but especially the synchronous communication in 3 and the shared objects in 5 are only weakly supported, if at all. The authors' solution to the problem is TeleNotes, an application built upon the Lotus Notes system (see section 2.2.8). TeleNotes uses a "sticky" metaphor where brief notes of communication organised in stacks float above other windows to serve as a reminder to the user of communication in progress. These stacks also contain hyperlinks that can be used to access e.g. documents and synchronous voice and video communication.

2.2.5 COM

The conferencing system KOM was developed at Försvarets Forskningsanstalt (FOA, Swedish Defence Research Agency) in 1978 inspired by Turoff, the developer of the EIES system (Palme 1995a). English releases were named COM. COM provides the capability to post messages in different groups and supports private and secret meetings/conferences. A message sent to several recipients exists only in one place (instead of sending copies of identical messages to all recipients). The COM-system supports dialogues by allowing the user to go to the previous (and next) message in the same dialogue, or simply skip a whole branch of messages in an uninteresting discussion. Therefore it is easy to follow a dialogue even if you enter a discussion after a long time (Palme 1990). The feature of following dialogues is important (Severinson Eklundh 1996), but still missing in many of the modern email systems.

The same message can be posted to several conferences while no recipient will have to see the message more than once. Messages in COM were stored for approximately four months.

The COM system, and later the PortaCom system, were used by the Commission of the European Community as a central information exchange hub for several European cooperation projects. This system is known as EuroKOM and is run at the University College of Dublin (Palme 1995a).

A new version of COM with a graphical interface will be released late in 1998 and will be running on PC's, Macintoshes, and Unix machines. The new COM version will have a text interface as well and will have support for a common address book for the site, as well as private address books. Some innovative features are: messages can be erased automatically after a folder specific time, additional recipients can be added to, or subtracted from, a message even after the message is delivered, and inquiries and voting will also be supported (Palme 1995a & b; Palme 1997).

Palme has also written a checklist with desirable email and computer conferencing features. The list includes features which, according to Palme, are important to users, but seldom provided by existing email systems. Many of these features concern overview and organisation of the message data base (Palme 1995c).

2.2.6 Information Lens

The Information Lens was developed by a group led by Thomas Malone at the Massachusetts Institute of Technology, and is a system designed to support people in managing their electronic mail and other electronic messages. Information Lens has received a lot of publicity and many of the ideas have been incorporated into commercial products. There is an advanced filtering possibility available, designed both to save users from junk mail and to find messages of interest, even though the messages were not directed to the user originally. The filtering system supports cognitive, social and economic filtering. The cognitive filtering is a match between needs of a user and the contents of a message. Messages about topic A are matched with users that have expressed an interest in topic A. The social filtering is based on personal and organisational relations. The economic filtering is based on message size (Malone, Grant, Turbak, Brobst & Cohen 1987).

The user can let Information Lens organise email semi-automatically. The user defines rules based upon the contents of email and the email messages are stored in different folders based upon these rules.

In Information Lens it is possible to define message templates. These semi-structured messages can be used for the filtering and for more advanced tasks such as communication with other applications.

Another concept in Information Lens is the “anyone server” where users can send out a message to an undefined group of users, the subset of the users that have defined rules that match the properties of the message. The idea was that it would support users with similar interests to communicate without necessarily knowing each other (Bannon 1993).

Information Lens has been further developed with the experimental systems Object Lens (Lai & Malone 1988) and Oval (Malone, Lai & Fry 1992).

2.2.7 Andrew Message System

The Andrew Message System (AMS), is a part of the Andrew project at the Carnegie Mellon University, see e.g. Gliedt (1994b). The high-end interface to AMS is *Messages* that runs under several window management systems and can convert messages from and to other mail file formats (Gliedt 1994a).

Messages has a set of features called “active messages” that in addition to the message content also has information that directs interaction with the user. Examples are voting messages, return receipt requests, enclosures, subscription invitations, and redistribution messages. For the receiver the active messages appear as messages that bring up dialogue boxes and ask questions that can be answered by e.g. selecting items in menus and check boxes (Borenstein and Thyberg 1988, 1991).

AMS transparently supports messages which include text, pictures, animations, spreadsheets, equations and hierarchical drawings, while supporting text-only communication with low-end machines. In Messages it is possible to use a LISP-like language called FLAMES (Filtering Language for the Andrew Message System) that can be used to automatically sort or classify new mail when it arrives.

The Andrew Message System also supports group communication by bulletin boards. The bulletin boards can be private, public, official, administrative or any combination. The successor of AMS is planned to handle more than 10.000 users and 30.000 mail and bulletin board folders at Carnegie Mellon (Andrew 1998).

2.2.8 Lotus Notes

Lotus Notes is a client-server based office system that runs on several platforms and is promoted as a tool for communication, collaboration, coordination, and central access of data (Lotus 1996). All data is stored in databases and the smallest information unit is a document. Documents in Notes may contain formatted text, pictures and audio. Two basic concepts are *views* and *forms*. Views are used to display summary data from each document and display an organisation of the document collection. Each document may have several different views. Forms are used to enter data into a document. The database system also contains functionality for access control and encryption.

With these basic elements applications for sharing data can fairly easy be developed and adapted to small groups.

Notes is sometimes considered as a de facto standard for groupware and several studies have been made of use of the system (Orlikowski 1992; Vandenbosch & Ginzberg 1996a, 1996b; Whittaker & Sidner 1996; Lai & Turban 1997; Essler 1998). Even whole books have been dedicated to describing implementations of the system (Lloyd & Whitehead 1996). However, the shared databases in Notes that have made it a leading groupware system are not necessary for usage of the system. In the studies described in chapters 5 and 6, the email part of the Notes system was the only part used in practice by most respondents.

The email database in Notes does not differ from the other databases. The list of email messages may have different views, for example sorted after date, subject, or sender. The only part of the standard Notes interface that reveals that the email function is considered central is the mail icon that is always visible in the frame. The icon gives visual feedback when new messages have arrived and provides a short-cut to the email database.

Notes has functionality for *replicating* databases. For people that work in several different places and e.g. sometimes connect to the database system via a modem, this gives possibilities to store a copy of a database locally on e.g. a laptop, and when connections to the main database are made the system updates databases in both places with the latest transactions.

Direct manipulation may be used to move messages into folders (*categories* in Notes terminology). Addressing is made with real names (e.g Olle Bälter), when the entered characters are unique for a person, Notes fills in the rest of the characters.

Attachments can be added to any document (including email messages) as a link if the document is stored in a Notes database or as an inclusion in other cases.

There are possibilities in Notes for the sender of a message to get an acknowledgement of reception in return when a recipient has for example opened the message.

2.3 Email and computer users

This section reports some differences in computer usage between novice and experienced users. Email usage has spread from homogeneous groups of technically oriented users to work places in general. Initially, email was used mainly in workplaces that already had computers, but lately the communication possibilities that a computer brings has made email access a reason to introduce computers in workplaces. Today email access is also becoming common in homes. This development will include new user groups in the email community, among them computer novices.

Allwood (1990) writes that the novices often have an incomplete, poorly integrated, partly erroneous and diffuse picture of computers. At the same time these novices may often have a thorough understanding of the domain, that is the work tasks that should be performed with help from the computer.

Prümper, Frese, Zapf & Brodbeck (1991) have studied how novices and experienced users make errors of different types in normal office work. In their study the

experts did not make fewer errors than novices (with the exception of knowledge errors), but the experts spent less time handling these errors than novices.

They divided their 174 clerical workers in three different ways into expert categories: computer, program, and daily-work expertise. The computer expertise was based on total length of time working with computers, the program expertise was based on the number of programs they knew, and the daily work expertise on the percentage of the day they worked with computers. The division into expert or novice was made on the criterion of one year experience, knowledge of one program, and usage of the computer half the day. Their subjects were observed during their normal work with their computer.

There were no significant differences between computer novices and experts in the total number of errors in the Prümper et al. study. Program experts made even significantly more errors than the program novices. The only novices that made significantly more errors than experts were the daily-work novices that used computers less than half the day on average. Their conclusion is that it is not important to avoid errors in itself, but rather that it is important to provide users with the possibilities to recover from these errors by providing them with more explanatory error messages and also suggestions on how to solve the problem that caused the error message.

Kasik & George (1996) mention that novices follow unexpected paths and do things that "no one would ever do". This may be explained by the novice users' lack of knowledge of what an application can and cannot do, and how the application should respond to a particular input.

Hjalmarsson, Oestreicher & Wærn (1989) report that when what they call "elementary users" (two secretaries) ran into a problem, they preferred to ask an expert for advice rather than using the help functionality in the system. Both the paper documentation and the on-line help were said to be difficult to handle and to understand in most situations. The two "advanced users" (technicians) used the documentation more.

Their study also indicates that "different users have different requirements" and that elementary users could not explain their needs or express their requirements. Some requirements that the users did not think of spontaneously were revealed through explicit questions during interviews. Hjalmarsson et al. suggest that this may be due to the lack of knowledge about what to demand, but also the habit of adapting to whatever technical tool is provided, and thereby not demanding anything from the tool.

Hjalmarsson et al. suggest solutions to some of the problems: A modular design in which various subtasks can be performed in different ways and that the end-users should be involved in the design process. One way to define subtasks is to use task analysis. Sending a letter could for example be divided into: writing, addressing, and posting. For each of these subtasks different design solutions are possible. Writing the message could be done with several different tools, addressing could be done manually or with the help from an address book, and the posting could be done by dragging an icon of the message to a mailbox or by clicking a send button. According to Hjalmarsson et al. the design should not be based upon task analysis alone as both the system designer and the end-users may have other solutions. A system designer may have an insight in technical possibilities to radical changes. The user may have insights in the informal work habits and exceptions that surrounds the formal ways of working.

The HomeNet project

Most of the studies on email users described in this chapter were made in academic organisations or technical companies. This is natural considering that these were also the first to use email, but it is doubtful that the majority of email users in the future will have an academical or technical education. The Jonrad study described in chapter 5 concerns non-technical users: nurses and physiotherapists.

The HomeNet Project is an attempt to understand the public's use in the United States of Internet-based electronic services at home by providing 110 households in Pittsburgh with a Macintosh, a modem, and a connection to Internet with individual accounts for each of the 229 members of these households (Kraut, Mukhopadhyay, Szczypula, Kiesler & Scherlis 1997). This equipment was provided at the cost of allowing the research group to log usage data and interview the participants (Kraut 1996; Kraut, Scherlis & Mukhopadhyay, Manning & Kiesler 1996a and b). Their study may be used as an example of non-technical users' usage of email. Their findings indicate that if Internet access is made available in the home it will be used to the same extent of people with different education and income, but whites, males, and teens were more likely to use Internet than minorities, females, and adults respectively.

Kiesler, Kraut, Mukhopadhyay & Scherlis (1997) have observed that email is crucial for Internet usage in the HomeNet study. Email usage was more popular and their respondents continued to use email to a larger extent than the World Wide Web. Email usage was also more stable over time than the Web usage. Email communication was often initiated after meeting the receiver in real life and many of the participants renewed friendships with people they had known earlier, but did not meet any more.

Kiesler et al. also offer some explanations for this: email is personalised, spontaneous, and interactive. For these users the content of email messages was normally directed to the receiver as an individual, email messages were normally sent to people that they communicated with by other means daily, and messages were usually sent as a reply to other messages or on the basis of previous interactions. In Kraut, Mukhopadhyay, Szczypula, Kiesler & Scherlis (1997) this is expressed:

> Each message is incomplete by itself, and like a soap opera, is "continued in the next episode" (p 23).

Kraut, Lundmark, Kiesler, Mukhopadhyay & Scherlis (1997) also give examples of participants that made new acquaintances via listservers, newsgroups, chat services, multi-user dungeons (MUDs), or Internet relay chat (IRC), but also that usage of these services for that purpose was not frequent. Those that made contact through these systems often used them for initial communication and then started to communicate via email with each other.

In the beginning many participants had difficulties getting started, and even after a year of Internet usage, the computer skill they initially had still constrained their Internet usage, regardless of gender and age. Over 70% of the households called the help desk, but these were the users that continued to use the HomeNet. The users that encountered problems and did not call, left the project (Kiesler, Kraut, Lundmark, Scherlis & Mukhopadhyay 1997).

Adapting interfaces to users

It is important to match the interface to the users' abilities and experience. Trumbly, Arnett & Martin (1993) made a study where they matched 32 users' level of experience with two different interfaces to perform the same task. One interface was made to suit the novices by using menu dialogues, colours, default values, long error messages, and automatic transfer to the help function when errors occurred. The other interface was styled for experienced users with a command dialogue, no colour, very short error messages, no default values, and a help function that had to be activated manually and contained short help messages.

Half of the experienced users performed the simulation game with the interface for the novices, half with the interface for the experts. The novice users were divided in the same way. Their performance were measured in terms of error ratio, reply time[1], and profit (the task was a simulation of manufacturing). The experiment yielded significant better performance regarding error ratio and profit when the interfaces were matched with the users' experience. Experienced users performed better with the interface designed for experienced users compared to the interface for the novice users. Novice users performed better with the interface designed for novice users, compared to the interface for the experienced users. No significant differences could be found regarding reply time.

The division into novice and experienced user is static and will not fit those users that are in transition from novice to experienced user, which includes many of the novice users. Instead of adapting only the user to the interface, it is possible to also adapt the interface to the user.

In a continuation of the study described above, Trumbly, Arnett & Johnson (1994) made an intermediate interface to the same manufacturing simulation on the basis of the novice interface, but with no colours, shorter error messages, and a help system that had to be activated manually. The adaptive version of the interface initially was the same as the novice users' interface, but when a user performed a task without errors, the interface changed to the intermediate version, and after another error free period finally to the experienced version of the interface.

While the novice users still performed best with the novice interface and the experienced users with the interfaced tailored for them, the adaptive interface was better than mismatching interfaces and users. Their conclusions are that adaptive interfaces could reduce training time and still produce an increase in overall performance.

1. Time between an application prompt to the user for information and the user's response.

2.4 Email as a communications medium

Email has unique features that make it a new medium, different from others. Palme (1995a) writes that email covers a gap between other media by the possibility of reaching groups of 8-1000 people in a day or less according to figure 2.3.

Figure 2.3 Speed and size of the user group in various media (after Palme 1995a).

Another way to view communications media is to divide them according to time and place as displayed in table 2.1. Although email is an excellent tool for communication in Different-time-and-place, its simplicity and speed has made it a choice for all other categories as well. While e.g. paper messages left on a persons desk clearly belong to the Same-place-different-time category, all media in the Different-place-and-time category are used both at the same place and at the same time. Email messages are sent to people present in the same room in order to not disturb them, used as a replacement for short paper messages (e.g. phone home), and as a replacement for phone conversations in settings where e.g. privacy or access to phones are a problem.

Table 2.1 Time-place functions of different media (after Palme 1995a).

	Same place	Different place
Same time	Face-to-face meetings	Phone, video and audio conferences
Different time	Paper messages	Electronic mail, voice mail and conferencing systems

In all, the simplicity of email usage in combination with the non-intrusiveness that follows from the asynchronous communication has made email a frequent choice for communication regardless time and place constraints. This asynchronousness eliminates some of the disadvantages of telephone calls. Only a quarter of all business phone calls are completed on the first attempt, and half are one-way transfers of information (Bransby 1990). One reason not to use email is problems with privacy (Weisband & Reinig 1995), with respect to security: an email message should normally be

regarded as a postcard, not as a sealed message in an envelope.

Email does not only replace other means of communication. Email also makes people communicate with more people (Hiltz & Turoff 1985; Feldman 1987), more often (Palme 1995a), and about new subjects (Palme 1995a). In an examination of communication in the COM system users claimed that 50% of the written messages, 75% of the read messages, and 65% of the time used in COM was new communication that did not replace other means of communication (Palme 1981). Respondents in Feldman (1987) estimated that 60% of the email messages they sent was communication that would not have occurred without email.

Email communication has similarities with several other media. In a study of 13 email users in a telecommunications organisation (Lea 1991) the respondents were asked to grade email as similar to other media in five “dimensions”:

- spoken vs. written communication,
- spontaneity,
- inconsequentiality (important, directed, or informative or not),
- emotional quality (emotionally poor or rich), and
- technology-mediated.

The written and the asynchronous nature of email was perceived as similar to note and letter writing. In terms of spontaneity email was perceived similar to telephone and face-to-face communication.

The writing style in email is considered as something between written and oral communication (e.g. Swales & Feak 1994; Markus 1994b; Peckham 1997). Severinson Eklundh (1986, 1994) argues that the usage of email differs between users and for those that use the system frequently, email replaces and resembles spoken communication. Email messages often have characteristics typical of spoken language and may contain e.g. play with spelling (Peckham 1997), interjections and informal expressions, while greetings and salutations often are omitted (Severinson Eklundh 1986). This form of communication violates the rules of the written language and may cause misunderstandings (Stein & Yates 1983). The absence of information about the receivers and perceived ephermality of email messages may cause the senders to use strong language in order to get the message across (Sproull & Kiesler 1991).

All this is suggested as reasons why *flaming* (message exchanges with strong expressions of negative emotions) occur in email conversations. However, Lea & Spears (1992) argue that significant social information can be communicated in computer-mediated communication systems even though they lack visual and auditory channels, for example by linguistic style. In their experimental study paralinguistic marks (ellipses (...) and exclamation marks), misspelling, and mistyping (reversed order of two characters) were shown to have an effect on how the readers of these messages perceived the writer’s intelligence, dominance, competence, originality, liveliness, self-confidence, verbal fluency, responsibility, and assertiveness.

Smileys, or emoticons, are sometimes used in email messages to express emotions by imitating face expressions. Examples are :-) happy, ;-) flirting, :-(sad or angry. The reader’s head should be turned counter-clockwise in order to interpret the figures.

2.4.1 Theories explaining media choices

There are several theories that attempt to explain why people choose to use a certain medium. Three of them are media richness theory, social influence models, and critical mass theory.

Media richness theory

Media richness theory characterises media by their ability to handle immediate feedback, possibilities to show feelings, multiple cues (e.g emphasis in both voice and choice of words), and natural language[1] (Daft & Lengel, 1984). Daft & Lengel ranked different media on a lean-rich scale with face-to-face communication as the richest medium. Their theory suggests that media should be chosen to fit the task in order to maximise efficiency. They divide tasks into *uncertain* and *equivocal*. Uncertainty can be regarded as absence of information, and uncertain tasks need more information in order to be resolved. Equivocality can be regarded as a situation where several conflicting interpretations exist, and it is difficult to access objective data. According to their theory equivocal tasks should be handled in rich media, while tasks that are uncertain should be handled in lean media. Examples of rich and lean media are displayed in figure 2.4.

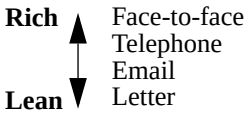


Figure 2.4 Examples of media on a lean-rich scale.

Email is according to this theory a lean medium, and there exists empirical support for the theory, e.g. Daft, Lengel & Trevino (1987); Adams, Morris & VanScotter (1998) where managers were asked to select the medium of communication they would use for different tasks. However, several studies have also shown that email is used as a richer medium than the theory predicts (Markus 1994b; El-Shinnawy & Markus 1997; Camino, Milewski, Millen & Smith 1998; D'Ambra, Rice & O'Connor 1998). According to Camino et al. the media richness studies have focused on the sender of messages, while little or no research has been made on how the recipients replies to messages (Rudy 1996). Rudy also suggests one problem with finding empirical support for this theory: individuals do not always behave as they would like to behave, and may consider other factors in decisions on media choice in real situations. A review of the literature on media richness is given in Zack (1993).

Social influence models

According to social influence models, individuals' choice of media is influenced by colleagues and other organisational considerations (Fulk, Schmitz & Steinfield 1990).

Although Adams, Morris & VanScotter (1998) found support for Media richness theory in their study of 178 Air Force managers, the higher managers were not as

1. Natural language can be both spoken and written. In face-to-face meetings, body language adds information richness.

"media sensitive" as media richness theory suggests. Their conclusion is that organisational context and social cues may also influence media choices.

In a study of more than a thousand voice mail users, Caldwell & Uang (1994) concluded that message urgency, message content, and distance between sender and receiver significantly constrained the choices. Reichwald & Goecke (1994) write that there are three key factors that influence communication for managers: innovation leaps in telecommunications (e.g. introducing of new communication technology), globalisation of business and management processes, and mobilization of managers (e.g. increase in business trips, multiple offices). All these influence corporation structures and the task-related use of telecommunication media.

Critical mass theory

According to critical mass theory, individuals can only benefit from a communication medium if others in their communication network also choose to use the same medium. Cost and benefit of communication systems have a social component that is likely to change with time. Costs are often reduced and benefits increased with the number of people that use the system (Kraut, Cool, Rice & Fish 1994).

Kraut et al. (1994) made an 18-month behavioural and technical trial of two desktop video telephone systems comparing media richness, social influence, and critical mass theory. Their conclusion was that although there were some support for media richness theory, it cannot explain why one of the video telephone systems failed. Social influence and critical mass theory however, could be used to explain this failure.

2.4.2 Organisational change following email usage

According to Rudy (1996) little has been done to study the effects of electronic mail at an organisational level. Especially non-quantitative studies and surveys of real organisations are missing.

Holti (1996) reports in a study of more than 20 companies that access to electronic communication does cause changes to the organisations, but it is difficult to predict which. He recommends making introductions of and changes to communication systems an iterative process.

Sproull & Kiesler (1991) have studied the introduction of electronic mail into organisations and describe the changes that may follow the new medium. Email has been used in some organisations to delegate control to employees and more flexible work groups. In other organisations the same technology has been used to increase management control over information and reinforce hierarchies. Boogaard & Huysman (1994) argue that information technology prevents organisations to change. They give reasons for this such as that the installed information systems are inflexible to changes and do not provide enough possibilities to handle relevant uncertainty, diversity, and change indications. This may delay detection of needs for organisational change.

Orlikowski (1992) concluded that both people's mental models about technology and their work, and the structural properties of the organisation, such as policies, norms, and reward systems influence the outcome of a groupware installation.

Sproull & Kiesler group the consequences of introducing computer-based commu-

nication in an organisation into social and technical factors. They conclude that it is very hard to predict the consequences of email technology, especially socially. In the beginning, the technical consequences are most apparent, especially increased efficiency. The efficiency increase is mainly due to the speed and asynchronousness that result in an accelerated flow of information. The changes in social relationships surface more slowly but some are (page numbers refers to Sproull & Kiesler 1991):

- People communicate with new people (pp 133-134)
  Questions can be sent via email to a group of people that the sender does not know. This reduces the time for new people in an organisation to learn the "folklore" that never occurs in journal articles or manuals but is necessary to make things work. On the negative side, it may also increase the information overflow when many recipients repeatedly receive the same question. One way to handle that problem is to store questions and answers in a database.
- Dependents change (p 108)
  When people communicate with new people they receive information from new sources and the old, maybe formal, ways of achieving information become less important. This may change the relation of power between the parties involved in the information interchange. Assignments can be given directly by email without passing any superiors.
- Formal status becomes less important (pp 59-63)
  Many things are less apparent in email: gender, looks, voice, position and status. According to Sproull & Kiesler men speak more than women, and managers more than employees in face-to-face meetings, regardless who is the expert on the area of discussion. The lack of these cues in electronic communication may therefore give more people a chance to have their say, and also improve the quality of the decisions.
- The way people behave and think may change (p 35)
  When information comes from new sources, people may start to think in new directions and work with other people. Groups may be distributed and still have a rich communication. Large organisational electronic groups may be considered as an information buffer, a way to organise information that are easy to access by asking the whole group.
- More discussions are needed to achieve consensus (p 65)
  When the formal status becomes less important, as mentioned above, it becomes more difficult to use status to enforce decisions compared to face-to-face meetings. Everyone can have their say. Those that oppose a decision can continue to write messages independent of time while traditional face-to-face meetings have to end.

According to Sproull & Kiesler electronic communication is more honest and straightforward than meetings and telephone because the sender is less aware of the receiver.

> Computer interviews, like email, create a feeling of privacy. This sense of safety makes interviewees somewhat more willing to disclose information than they are willing to disclose in face-to-face interviews or on paper-and-pencil questionnaires (p 45).

For face-to-face meetings there are social norms, both implicit and explicit, while electronic communication introduces new social situations with few known or generally

accepted norms (p 37-39). This implies that norms cannot be used in the same way to e.g. make the arguments of an organisational superior more important than others'. Sproull & Kiesler conclude:

> Computer-based communication allows people to work somewhat more efficiently, but the realized benefits depend ultimately on the policies, designs, and vision of people who want to work in new ways (p 175).

Feldman (1987) has made the same observations as Sproull & Kiesler when it comes to the first three items in the list above. Feldman collected data from 96 people in two divisions of a Fortune 500 company during three months.

Sumner (1988) in an interview and survey study of 36 experienced email users noted that email provided lateral linkages throughout the organisation. This is similar to the first two items in the list above. However, Sumner could not find any support for changes in social structure when it comes to changes from hierarchical to network organisations, expanded group size, and reduced status distinctions.

Nance (1996) describes, in an interview study of sixteen senior managers in five large Silicon Valley companies, that both information technology (IT) and the group that handles the information systems (ISG) have key roles in organisational changes. Nance argues that both IT and ISG can function as *enablers* and *drivers* of change. The study gives examples of how managers were driven by business or management needs and found enablers in both IT and ISG. Nance also gives examples of IT and ISG as drivers, e.g. software packages that the organisation adopted and eventually changed the organisation. An example of ISG-driven change is beta-testing of the organisations' products that changed the way organisations tested their products that resulted in improved quality of their products.

2.4.3 Introduction of new communication systems

Introductions and installations of email systems are not the focus of this thesis. However, some knowledge of the problems with installations are of value, since both the MainframePC study in chapter 4 and the Jonrad study in chapter 5 were made at the time of installation of an email system. This section describes introductions of groupware systems, including email systems.

Introducing groupware in an organisation is a complicated task, and many studies have been made. Plowman, Rogers and Ramage (1995) have made a summary of important studies of computer-supported cooperative work (CSCW) systems, among them CSCW systems in the workplace. Their conclusion is that workplace studies can contribute significantly to introductions of groupware systems by providing insights into the social, cognitive and technical aspects of work. Lai & Turban (1997) came to the same conclusion in their study of the Housing and Development Board in Singapore.

Why is the introduction of a groupware system so complicated that a workplace study is necessary? Grudin (1994) has made the observation that successfully overcoming technical hurdles is far from a guarantee of success. He has defined eight challenges for the developer of a successful groupware system, which may be useful also for those that introduce the systems:

1. *Disparity in work and benefit*
   Groupware applications often require additional work from individuals who do not perceive a direct benefit from the use of the application. Grudin's (1988) classical example is the use of calendar programs that were appreciated by managers, but much of the information had to be entered in the systems by employees that did not use calendars. An example from the academic world is documents that used to be handed in to teachers, nowadays often are sent via email and the teacher has to do the printing. In some cases, when students are using a different computer type than the teacher this requires a large amount of extra work for the teacher just to print the document.
2. *Critical mass and Prisoner's dilemma problems*
   Groupware may not attract the "critical mass" of users required to be useful, or can fail because it is never to anyone individual's advantage to use it. If an email system is introduced and only a few people use it, the benefits from the system are limited and it becomes difficult to attract more users to the system.
3. *Disruption of social processes*
   Groupware can lead to activity that violates social taboos, threatens existing political structures, or otherwise demotivates users crucial to its success. The communication possibilities may short-cut hierarchies and, as described by Sproull & Kiesler (1991, see also page 38 in this chapter), the importance of formal status is reduced and it is more difficult to achieve consensus.
4. *Exception handling*
   Groupware may not accommodate the wide range of exception handling and improvisation that characterize much group activity. The groupware system may enforce formal rules that in practice often are violated. Examples are breakdown of a machine or unplanned absence of a key person.
5. *Unobtrusive accessibility*
   Features that support group processes are used relatively infrequently, requiring unobtrusive accessibility and integration with more heavily used features. Grudin gives an example of co-authoring tools that preferably should be the same word processor as the authors use for solo writing activities. During co-authoring, tools and functions for annotations, version tracking, and distribution of drafts should be easily accessible. During solo writing, they should be invisible.
6. *Difficulty of evaluation*
   A groupware system cannot be evaluated by studying an individual only. The many different users involved are interacting, often simultaneously, which makes it costly and difficult to evaluate the usage.
7. *Failure of intuition*
   Intuitions in product development environments are especially poor for multi-user applications, resulting in bad management decisions and an error-prone design process. Grudin argues that intuition is based on experience, and system developers have much more experience of single-user applications than multi-user systems, and use this single-user experience while developing multi-user systems.

8. *The adoption process*
   Groupware requires more careful implementation (introduction) in the workplace than product developers have confronted. The system is often introduced to change work habits and it may be complicated to overview all consequences, especially socially (Sproull & Kiesler 1991, see also page 38 in this chapter).

The research of Sproull and Kiesler (1991) described above discusses the consequences of *introducing* an email system in an organisation that has not used email before. According to Sproull & Kiesler, these consequences may be significant and e.g. increase information overflow and change relations of power and status. Today many organisations face another problem: replacing an old email system with a new.

Kleintop, Blau & Currall (1994, 1996) write that upgrading to new software packages is different from implementing entirely new software systems. They have performed a pre- and post-study one month prior and one month after a replacement of a "successful yet obsolete" email system with a new email system. For more than a month prior to the implementation of the new email system a test version of it was installed that users could train on and test functionality. The authors' conclusions are that users' expectations of usefulness, ease of use, and post-implementation training did not affect their usage of the new system. However, the employees' sense of participation in implementing the new system and their experience of using email systems were strongly related to usage of the new system. Those who used the old email system, also used the new system, but those that used the old system frequently were less likely to hold positive attitudes prior to the implementation of the new system. Kleintop, Blau & Currall suggest that possibilities to work with the new system prior to the implementation could reduce negative attitudes.

However, their results about users expectations are contradicted by both the results in Hiltz & Johnson (1990) and their summary of other studies where user expectations were an important variable for acceptance of a CMC-system.

Jakobs, Procter & Williams (1996) write that there exist two barriers to successful implementation of email systems: different generations of technology which are incompatible and the substantial investment made in learning by the users of the old system.

In summary, an introduction of an email system is a complicated task and replacing an old email system with a new one may be even more difficult. Careful planning and user studies to identify real needs are necessary.

2.4.4 Managers' communication and email usage

Managers' abilities to communicate efficiently are considered to influence their employees' performance and work satisfaction (Alexander, Helm & Wilkins 1989). Their abilities to collaborate with customers and to give feedback to their employees may increase productivity (Hessner 1993). This implies that email could be a suitable medium for managers as email is considered as an efficient medium for communication.

Mackay (1988) described a manager that had a secretary that handled the manager's email based on five different actions that the manager flagged delegated messages

with: “please file”, “take some action”, “please reply to”, “for your information”, and “remind me”. The reasons why she used email was that she regarded email as an efficient way to keep informed about events in her lab, record interactions, and to communicate while travelling. This example illustrates the different situation for managers compared to employees.

Several studies have shown that managers are under time pressure and that one of the most severe problems is that they are repeatedly interrupted (Carlson 1951; Stewart 1967; McCall, Morrison & Hannan 1978; Edlund 1990; Tollgerdt-Andersson 1995). In a workplace study by O’Conaill & Frohlich (1995) the subjects were on average interrupted four times per hour. This frequency is likely to be higher for managers. The number of interruptions could be reduced by using email or other asynchronous media. Barbará, Clifton, Douglis, Garcia-Molina, Johnson, Kao, Mehrotra, Tellefsen & Walsh (1993) write:

> Many people are finding it convenient to interact with their secretaries or with a colleague next door electronically simply to avoid constant interruptions and to keep an organized record of tasks to be done (p 92).

However, Markus (1994b) reports about a mixed-method study of managers where both surveys, analysis of email communications, and interviews were made. Most employees in the studied organisation did not use email yet, but many managers in her study routinely allowed themselves to be interrupted by incoming email messages.

Markus also describes how users deliberately use email to avoid unwanted social interaction (Markus 1994a). Social communication demands between 60 and 80% of the available work hours for a manager (Burns 1954; Stewart 1967; Kotter 1982; Lawrence 1984). Among the many abilities wanted in a manager, the skills to communicate, maintain, and develop relations, and also to stimulate employees and other interested parties are considered to be among the most important (Tollgerdt-Andersson 1995). Luthans & Lockwood (1984) report in an observational study of 44 managers at different levels in several organisations that 29% of their time consists of “routine” communication, such as processing mail, answering procedural questions, giving and receiving information over telephone, and financial reporting and bookkeeping. Again, email may be suitable to handle a part of this communication.

One solution for overloaded managers may be to delegate more to their subordinates, but to delegate is a complicated task as Milewski and Lewis (1997) argue. There are several reasons for this. Managers fear that: quality will decrease, they will lose control and get less credit, the subordinate will fail, or they may be perceived as tyrants by the subordinates. Some tasks are a pleasure to perform, and these are not so easy to delegate. All this works against delegation.

Email raises demands on managers in many different ways. Moulton & Moulton (1996) argue that electronic communication can impact sales, revenue, costs, operations, strategic information, and employee relations. When an email system is to be introduced in an organisation, Wijn (1996) claims that it is very important that managers show that they are determined to use the mail system. This may decrease initial problems with attitudes among the employees such as “why should I spend time to learn this program?”. Isherwood (1996) advises that senior managers participate in all

aspects of groupware implementation planning due to the major impact on the organisation that a groupware system may have. Burke (1996) advocates that managers should participate in electronic debates with imperfectly written messages in order to enable the employees to contribute with proposals that do not have to be perfect from the beginning. Failla (1996) argues for the necessity of immediately taking "on board" the implications and the potential of a groupware application by the management. Andreu, Ricart & Valor (1994) claim that "the role of the corporate manager is of paramount importance for introducing IT/IS content in corporate strategy" and that the role of IT/IS is dependent of the organisational structure. All this shows how important it is that managers handle their email system well.

However, according to Lantz (1995, 1996) it is common that managers have problems handling their email. Whittaker & Sidner (1996) found that managers received more email messages than others and at the same time they had less time to handle them.

2.5 Email handling and organisation of information

Although email originally was intended as a tool for communication, the written messages stored in email systems are for many users a valuable source of long term information. For some users the amount of messages is so large that they create problems with overview of the information and these messages have to be organised in some way.

The next two subsections describe organisation of information in general and in particular email messages. The last three subsections describe problems of handling overflow of information, email messages, and communication.

2.5.1 Organisation of information

Organisation of information on computers has borrowed names and features from the real world: e.g. files and folders. It is therefore natural to examine how information is organised in the real world when designing computer systems for organising information.

Malone (1983) interviewed ten people at an industrial research centre and a large medical clinic. The subjects gave the interviewer a tour of their offices, describing what information was where and why, and how well they felt their offices were organised and what problems they had with organisation. Six of the interviewees were also asked to locate several documents in their office.

According to Malone, those who had neat offices (structured filing system) also had fewer difficulties in information retrieval, overlooked fewer things they had to do, and were better at finding specific target documents on request compared to those that had messy offices.

Several of the subjects with neat offices mentioned that they "couldn't stand clutter" and Malone drew the conclusion that the ability to hide some of this clutter may be an important advantage of a computer system.

Another observation was that the subjects' desktop piles were untitled, but that

most computer systems require new documents and folders to be named.

The purpose of these piles are not only to store information for later retrieval, but also to remind the subjects to do something. Here illustrated by two quotes from Malone's subjects:

> If I don't put it here where I can visually see it, I won't do it (p 107).
>
> You don't want to put it [a pile on the desk] away because that way you never come across it again (p 107).

Malone concludes that computers can support organising of information in at least three different ways: creating classifications, classifying information, and retrieving information. For the last two Malone also gives suggestions.

Classifying information can be supported by allowing *multiple classification* (one message in several categories), *deferred classification* (allowing information to be stored without assigning a label to it e.g. by storing it in different physical locations) and *automatic classification* based on the information in the headers of the document.

Retrieving information could be supported by allowing the user to search in several "dimensions" simultaneously (e.g. time, sender, subject). This is also possible in most email systems today.

Malone also gave suggestions for how computer systems could support reminding by determining a priority to messages and using this to display messages with different frequency (high priority message more often), size, location, and/or colour. Ideally the computerised system would automatically change priorities with time e.g. when a deadline should be met.

One of the primary reasons to store information is to be able to retrieve it in the future. Lansdale (1988) writes:

> The purpose of IT should be to increase the quality, not merely the quantity, of available information (p 55).

He also states two points about information management. The first is that we remember far more about documents than can be used in retrieval procedures, for example the colour of the paper, position of figures and coffee stains, and when we received the document. The second is that there is a general problem with categorising items, both in which categories to use and to remember these at the time of retrieval. Lansdale refers to Dumais & Landauer (1983) who identified two problem with categorisation: it is impossible to generate unambiguous category names and information often fits into several overlapping categories.

According to Lansdale the messy offices described by Malone which contained unstructured piles were not a result of slovenliness; instead there was a mismatch between what a person needed to do and the facilities to do so:

- Some tasks demand that several documents are visible at the same time.
- The general problem with categorising items described above forces people to pile documents around the office.

These piles have advantages compared to storing documents in folders or binders such as using the spatial memory, and the automatic time ordering. Lansdale concludes that

although this pile strategy is only a compromise between different needs and possibilities it is of benefit for the user for a while until the sheer volume of documents overwhelms the office.

Lansdale argues that if we knew what people remember about documents we could improve search facilities to support this. He gives three relevant examples of what is known about human memory:

- the workings of the memory are such as to retain the meaning and gist of events, but not necessarily detailed information about them;
- we retain more information about events than we may be able to recall at any one time, and the ability to recall this information depends critically upon what we are thinking about at this time;
- memory techniques, such as the use of mnemonics and method of loci (see e.g. Anderson 1990, p 201) and memory for pictures produce excellent memory performance.

Lansdale's conclusions are that every attempt to retrieve information contains two different psychological processes: 1) recall-directed search followed by 2) recognition-based scanning. Information retrieval systems should provide support for multiple categorisation and be sensitive to synonyms. When it comes to storage or categorisation of information Lansdale points out a dilemma: the more time a user has to spend to categorise an item, the less likely it is that the categorisation will be done at all. The more we automate this process, the less the user will be able to recall due to fewer retrieval paths in memory (see e.g. Anderson 1990, pp 178-217). One possible remedy is *cue enrichment* (Cole 1982) that is to create an electronic environment with a rich variety of dimensions (such as colour, size, format, typeface, date) to provide the users with as many cues as possible to the same information.

2.5.2 Organisation of email messages

For email users who store their messages, practical strategies for organising email messages become important. As the email flow in general increases with the growing number of email users, this will lead to more email messages to handle. The more incoming messages, the more time has to be spent reading these messages. It takes more time to search among many stored messages than a few. It also takes time to write messages and replies. A first guess could be that all these problems would increase when the flow of email increases, but several studies have shown that there is no simple relation between the number of incoming messages and perceived problems with email flow (e.g. Hiltz and Turoff 1985, Mackay 1988, Bälter 1995, Lantz 1996).

By studying users it might become possible to identify strategies to categorise, store, and delete email messages that the users themselves are unaware of. When strategies are identified, they can be compared and the eventual disadvantages of certain strategies could be reduced by improved interfaces or functionality in the mail tools.

There are a few studies that have investigated the different strategies that email users have to handle their email. Mackay (1988) interviewed 23 people at a research laboratory and characterised email users as *prioritisers* or *archivers*. A prioritiser concentrates on the problem of managing incoming messages. The example prioritiser in

Mackay's study was trying to minimise the amount of reading by reading email only once per day, ignoring email messages that she did not find important, and was willing to occasionally miss even important messages (assuming that if they were *really* important, the sender would try to reach her by some other means). An archiver concentrates on how to archive messages for subsequent use. Mackay's archiver had 600 messages in his inbox and 40 folders. The stored messages were a mix of correspondence with personal friends, information "that may be useful some day", messages that required some kind of action from the archiver's side, and unseen messages. He expressed his unwillingness to delete messages by asking: "What percent of the ocean don't you like?"

Ann Lantz made a survey (Lantz 1995) and an interview study (Lantz 1996) of heavy users of email in a technical company. The survey had 58 respondents and 10 people were interviewed. In her studies it was found that distribution lists and personally addressed email messages raised problems in managing electronic information, while conference systems did not. Messages from customers and error reports were prioritised by the management and should be answered within a day, while other messages had to wait, especially if they needed a longer informative answer. This sometimes resulted in messages that were forgotten and never received a reply.

Nine of the ten respondents in the interview study reported difficulties in storing messages in a structured way. Lantz concluded that users did not have a defined strategy for archiving email messages, instead the folder structure was evolved heuristically over time.

In order to better understand different users' strategies for organising email messages Whittaker & Sidner (1996) made an interview and data logging study of 20 Lotus Notes users in several departments of Lotus Development Corporation. They grouped users into *No filers*, *Frequent filers* and *Spring cleaners* depending on their usage of folders and frequency of cleaning as displayed in table 2.2.

Table 2.2 Strategies based on usage of folders and frequency of cleaning.

	Use folders	Few/No folders
Clean often	Frequent filer	
Clean occasionally	Spring cleaner	No filer

A Frequent filer uses folders and makes at least weekly passes to archive messages in folders or delete them. A Spring cleaner uses folders, but does clean-ups more seldom than weekly. A No filer does not use folders and does clean-ups seldom, if at all. Whittaker & Sidner identified certain characteristics for these groups. The Frequent filers had fewer failed folders (folders with few messages) compared to others. Their Spring cleaners were aware of the mess in their inbox and described it with terms such as "disgust". They had more failed folders, maybe because they forgot the definitions of a folder name between the occasions they archive email messages. The No filers had completely given up their attempts to organise their email messages. They answered email messages when they could, but rarely browsed back among the old email messages to find possible forgotten messages. Like Mackay's (1988) prioritizer, they claimed that important email messages would be sent to them more than once.

Besides studying the strategies people use in their current mail tool, it is also important to improve the interfaces of the future mail tools to support the users' strategies better in organising email messages. Jones, Bock & Brassard (1990) report that users felt overwhelmed by the amount of mail they received, and were uncertain of the structure of the folders they had created. A direct manipulative interface was superior for organising messages by making the organisational structure visible, but also created new problems with synchronisation when several windows were opened at the same time.

Mander, Salomon and Wong (1992) have, as Malone, studied how users organise their papers, messages and other physical objects of information in real life. Their conclusion is that users like to group items spatially and often prefer to deal with information by creating physical piles of paper, rather than immediately categorising it into specific folders. Computer users are confronted with large amounts of information, but currently are often provided only with a hierarchical filing system for managing it. The Pile metaphor suggested by the authors was rejected by Lansdale (1988) that compared such ideas with building aeroplanes that flap their wings.

Belkin & Croft (1992) have made a study where they compared models for information filtering and information retrieval and came to the conclusion that there are important similarities. Both information filtering and retrieval are methods to provide the right people with the information they need. Both handle more or less the same kind of information in the same kind of context. This could be used to design similar interfaces for filtering and retrieval of email messages.

2.5.3 Information overflow

Information overflow, or overload, has been described in several ways. Sheridan & Ferrell (1974) described it as *information received at such a rapid rate that it cannot be assimilated*. Losee (1989) described it as the *receipt of more information than is needed or desired to function effectively.* The phenomenon of information overflow is not new. Yates (1989) describes how a manager in 1920 was reacting to information overload:

> I do not think it necessary to send these reports to me in the future unless to draw attention to some peculiar or abnormal condition. I shall depend on you to keep the inspections going, but the clerical work of making out the reports can be saved. If there are any other similar reports which you think can be cut out please give me an expression of your opinion with reference to the same (p 191).

The sources of information can be divided into two groups: push and pull. Pushed, or directed, information is information that you will get without an effort on your behalf, such as incoming phone calls, email, and letters, but also meetings with people that come to you. Pulled, or searched, information is information that you must actively do something to get, such as phoning a person, turning on a radio, subscribing to a magazine, or searching for information on the Web. In some cases media such as the radio is not under the control of the receivers and then it becomes a directed source.

Regardless of the source, information can be more or less interesting for the receiver. This degree of interest varies between persons for the same piece of informa-

tion, and with time for some pieces of information. In some cases information can be essential in order to perform a work task, such as the schedule for a class, or even to survive, such as the location of emergency exits on an aeroplane in case of an accident. This continuum of more or less interesting information is illustrated in figure 2.5. Messages classified on the left side of figure 2.5 are of no interest at all for the receiver. As we go right in the figure, messages becomes gradually more interesting until the right side where the whole message is interesting.

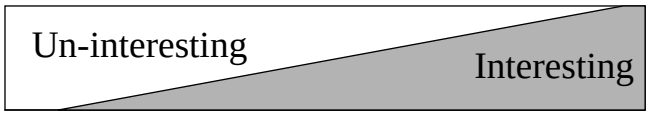


Figure 2.5 The continuous scale of interest of information. A piece of information (e.g. an email message) can be placed on the scale depending on how much of the information that is interesting for the receiver.

The difficulties with handling vast amounts of information is to access the interesting parts (shaded in figure 2.5) without passing through too much of the un-interesting parts (white in figure 2.5) or losing some essential information by ignoring some of the least interesting messages.

Another perspective on information is to look at the tasks that follow the information once it is received (Covey 1992). Tasks can be structured after their importance and their degree of urgency as illustrated in table 2.3. According to Covey it is important to strive to handle the important and non-urgent tasks in quadrant II in order to minimise the important and urgent tasks in quadrant I that have to be handled. The tasks in the remaining two quadrants are not important and should not be handled at all.

Table 2.3 The Time Management Matrix (after Covey 1992).

	Urgent	Not Urgent
Important	I: • Crisis • Pressing problems • Deadline-driven projects	II: • Prevention • Relationship building • Recognizing new opportunities • Planning • Recreation
Not important	III: • Interruptions • Some phone calls, mail, reports, and meetings	IV: • Time wasters • Some mail and phone calls

2.5.4 Email overflow

Email may be both a part of the problem and the solution to information overflow. Email may be a problem as it is another means of communication that may cause more unwanted information, or duplicates of information. Email may be a solution as it may simplify overview of email messages and deleting of unwanted messages compared to paper messages.

Email overflow has been studied by Hiltz and Turoff (1985). According to them, this overflow causes the users to:

1. answer only parts of the incoming mail,
2. answer less correctly than they otherwise would have done,
3. store information and answer it when they have time,
4. systematically ignore some of the characteristics of the incoming information,
5. stop using the system.

They conclude that information overload, within the context of an organisation, is essentially a behavioural phenomenon, not necessarily involving too much information that must be handled. Individuals must learn screening skills, select receivers more thoroughly, and develop shared norms about sending behaviour so as not to impose unwanted material on others. The authors suggest that it makes more sense to address inappropriate behaviour through social norms and sanctions than to try to solve the problem with software.

Mackay (1988) interviewed 18 of 60 people at a research laboratory as a pre-study of an introduction of Information Lens at that laboratory. In her study it was found that the feeling of being overloaded varies a lot among people, independently of the number of messages they send and receive. In Mackay's study one person felt that 36 distribution lists were few, while another person thought that 20 were a lot. One person thought that it was possible to control the email situation when receiving 75 messages a day, while another person felt overloaded with 23 messages a day. The users that feel out of control are often, according to Mackay, the persons whose work does not demand immediate response to mail, but feel that they cannot stop themselves from reading anyhow. Users who feel overloaded had some of the following characteristics:

- subscribe to many distribution lists,
- try to read all of their mail but do not always succeed,
- save hundreds of messages in their inbox,
- often do not reach the bottom of their inbox,
- want to save a large part of their mail,
- maintain many folders on different topics where mail is saved,
- have difficulty finding messages.

Both Hiltz & Turoff and Mackay concluded that large numbers of incoming messages were not the major cause of overflow problems for the receiver.

One problem with email is that email addresses can be collected automatically and used for distributing advertisements. Hall (1998) have a remedy to avoid such unwanted email by using different channels to send email messages. By using three different channels: send-only, private, and public; incoming messages may be instantly

deleted upon arrival. All messages to the send-only channel and all messages from others than accepted users to the private channel will be deleted. By e.g. using the send-only channel when surfing on the Web and posting messages in news groups, no email address collector program will find a useable email address to send advertisements to.

With a limited time available but at seemingly infinite flow of incoming email messages it is natural that the email user develops strategies such as those described by Hiltz & Turoff (e.g. ignore parts of incoming messages) and Mackay (e.g. limit reading and miss important messages) above. From the receiving users' point of view it might be more efficient to answer only certain messages instead of all.

2.5.5 Communication overflow

The term *communication overflow* was coined by Ljungberg (1996) and refers to a situation when a person is subjected to undesired communication. He describes the difference between information and communication overflow in the way that the first regards *information* and people's *inability* to handle it, while the second concerns *communication* and people's *undesire* to handle it. Ljungberg has applied Shannon & Weaver's (1949) model of communication extended by the notion of context (Watzlawick, Beavin & Jackson 1967; Dimbleby & Burton 1995) and views communication as something that takes place between a *sender* and a *receiver* that exchanges *messages* through a *medium*[1] within a *context*.[2] All of these, with the exception of the medium, may be a cause of communication overflow for the receiver.

Ljungberg argues that communication overflow occurs due to the sender or the message independent or dependent of the context, as illustrated in table 2.4.

Table 2.4 Causes of communication overflow (after Ljungberg 1996).

	Communication	
Context	Sender	Message
Independent	3	4
Dependent	1	2

Ljungberg gives examples of the four different cases in table 2.4:

1. We do not want to be interrupted by our grandmother during an important business meeting.
2. We do not want to read a message about crystal healing when we are preparing for a presentation together with a collaborator, although crystal healing is our greatest interest otherwise.
3. We do not want to communicate with an enemy, independent of context.
4. We do not want to communicate about topics that we find extremely boring.

However, Ljungberg's claim that communication overflow caused by the sender

1. Examples of media are email, face-to-face conversation, telephone, and video conference.
2. Examples of contexts are lecture, debate, sales situation, planned and unplanned meeting.

should be independent of the message can be questioned. A message from Hitler to Churchill would certainly be interesting if the message was unconditional surrender, regardless the context. Even a grandmother that normally only needs someone to talk to may have crucial information about e.g. your children that could be more important than any business meeting in the world. These examples may be extreme exceptions, but they illustrate a complexity in ignoring the context.

Severinson Eklundh (1986) studied the dialogue process in communication via the COM system, and discussed the nature of email dialogues compared to spoken communication. A problem brought up in her study (see also Severinson Eklundh 1994) is the fact that heavy users often do not deliver a response to a message within a reasonable amount of time. This may have the effect that the waiting recipient may try to attribute the silence to some particular reason. This can be frustrating for the waiting recipient since the real reason for the late or missing answer is overload and not lack of interest. This may be regarded as a result of the communication overflow of the heavy user.

3 Email in an Academic Research Laboratory

This chapter is a summary of my licentiate thesis (Bälter 1995). The aim of the licentiate thesis was to study users' email flow and organisation of email in order to suggest design improvements to email tools in general. The origin of the thesis was the development of CoMail, an experimental email system that was a part of the CoDesk project (Tollmar & Sundblad 1994, 1995; Pehrson & Sundblad 1994).

3.1 Purposes of the study

The licentiate thesis deals with two of the research issues defined in section 1.1: email usage and organisation of email messages. The general question treated in the thesis was "What factors influence the use and usability of email?". The main issues investigated were problems that email users had with:

- large amounts of incoming messages,
- user interfaces to email systems,
- technical problems,
- storage and organisation of email messages.

The purpose of the study was to identify possible improvements and extensions of CoMail and mail tools in general. The last theme has been present also in the two studies described in the following chapters.

3.2 Description of CoMail

CoDesk (Collaborative Desktop) was an experimental system that attempted to make collaboration a natural part of the daily use of a computer. The purpose of CoMail was initially to provide CoDesk with an interface to electronic mail. An email program in CoDesk should understand what to do when different types of icons were dropped onto the mailtool icon and vice versa. The development started with informal interviews of the secretaries and the computing facilities staff at NADA. The input from those interviews, and discussions with the IPLab group were used as a basis for the first version of CoMail.

Surprisingly, the secretaries were very pleased with email, even when they used such old programs as Unix mail. The computing facilities staff on the other hand had very many opinions on what should be improved in email programs. Most of the interviewed secretaries used email a few times per week while the computing facilities staff used email continuously every day. This may be the reason for the differences in opinion. When email is used infrequently, a simple interface with the most basic commands (read, write and send) seems to be enough. When email is used a lot, the demands on the interface and functionality grow.

With a working version of CoMail guest researchers and interested colleagues visit-

ing IPLab tried CoMail and provided valuable input. Three colleagues at IPLab used CoMail as their only mail tool for a period of between one and six months. They found errors, and their complaints and suggestions resulted in many improvements of CoMail. A formal user study of CoMail was made by two computer science students as a part of their Master's thesis (Hellgren & Olsson 1995).

The development of CoMail gave insight into some of the technical problems a developer of an email program must solve and also showed that user studies are necessary to understand the true needs of the users. This insight was used as input in the questionnaires described in 3.4 and the interviews described in 3.6. Another insight was the difficulty involved in testing a mail tool. It is very difficult to entice users to replace one of their main work tools with an experimental tool, as they may lose messages or their history of messages. This and the lack of supporting programmers are the reasons that no further development of CoMail has been done since 1996.

CoMail had basic email functionality to send and read email messages and was built as a graphical interface to the Unix mail handler MH. Some of CoMail's features are interesting to mention:

- In CoMail the email address, the name and the subject line were automatically extracted from each opened message and stored in an address book. The subject line was extracted to provide the user with a context if the name and the address would not be enough to remember the person.
- One of my colleagues had more than 10.000 messages saved, mostly in order to have the addresses stored somewhere. The address book functionality in CoMail was appreciated, but even if this person opened an old message every 5:th second, it would take almost 14 hours to scan through the old saved messages to collect the addresses. On his request a "scan" function was added to the address book that automatically extracted the name, address, and subject from all messages in all folders. The scanning still takes a while, but since it is a batch job no-one has to operate the program manually.
- One of the menus allowed the user to set a language. This was used for converting incoming Swedish messages with {}\ to åäö as a first step towards support for the user to convert incoming messages with distorted national characters. In outgoing messages the language state influenced the affiliation of email messages. When the setting was e.g. "English", an English affiliation was added to outgoing messages.
- CoMail had multi threading possibilities: several messages and folders could be opened at the same time. This provided users with possibilities to read messages at the same time as other messages were written.
- The help system in CoMail was context sensitive. The help command in each window gave explanations to the menu commands and other possibilities in that window.

3.3 Methods and subjects

In order to increase the possibilities for users to appreciate CoMail, I wanted the system to solve problem that users had with their ordinary mail tools. Therefore a questionnaire was sent by email to 32 users at a university research laboratory to identify email users' problems with email flow and organisation of email messages. Reminders were sent via internal paper mail. A total of 28 people answered the questionnaire. The users that responded represented both novice and experienced users as well as users with a low and high load of email.

The questionnaire covered areas such as size of email flow, general usability problems, organisation of email messages, address handling, and multimedia messages. Many of the questions were the same as Lantz's (1995) investigation of email usage at an industrial site, in order to make comparisons. A set of seven additional questions about the work situation were sent by email to the respondents, to clarify some possible causes of problems found during the evaluation of the first questionnaire. Yet another question was distributed via email a year later in order to investigate problems with national characters.

Professions found at the university site were Researcher/Teacher (9 respondents), Research student (12), Programmer (4), Student (2) and Secretary (1). The last two groups were small so they are here joined into a group called Other. All but two had academic backgrounds, with several different sciences represented. Email was used both for communication within and outside the university. Many kinds of computers and email programs were used.

The results from the university survey are described in section 3.4 and the comparison with Lantz' study is made in section 3.5.

In order to achieve a deeper understanding of the results from the questionnaires a set of twelve interviews were made. To gather views from as many different types of users as possible, the interviews were made with people in four groups:

1. Five technically educated people at a university.
2. Three people at the computing facilities group (that have a very high load of incoming messages) at a university.
3. Two technically educated people at a technical company.
4. Two non-technical people at two non-technical sites.

All had university education. As a preparation for the interviews, a questionnaire comprising the questions from the university questionnaire and the seven work situation questions mentioned above, was sent via email to the people in group 2 and 4 that did not participate in the questionnaire survey. The interviewees were asked to comment on their answers to the questionnaires and also to demonstrate their email system. During the interviews some of the answers to the questionnaire were validated, e.g. the number of messages in the inbox and stored messages.

The results from these interviews are described in section 3.6 and the last section summarizes the results from all these studies.

3.4 Survey results

When frequencies are mentioned in the results below, their mean value and standard deviation are written within parentheses (m#, sd#). The character # should in tables be interpreted as “number”. The complete questionnaires and answers are described in Bälter (1995). Here the results are divided into four areas: Size of email flow, General problems in handling email, Problems associated with email flow, and Organisation of email messages.

3.4.1 Size of email flow

With an increasing flow of email, more time must be spent reading and answering messages. A large flow may thus be a cause of problems. Therefore we asked:

6. How many email messages have you received and sent respectively in the last seven days?

Results are illustrated in figure 3.1 converted to messages per day. The respondents received between 4 and 280 messages in a day (m20, sd36). Each person sent between 1 and 20 messages a day (m6, sd4).

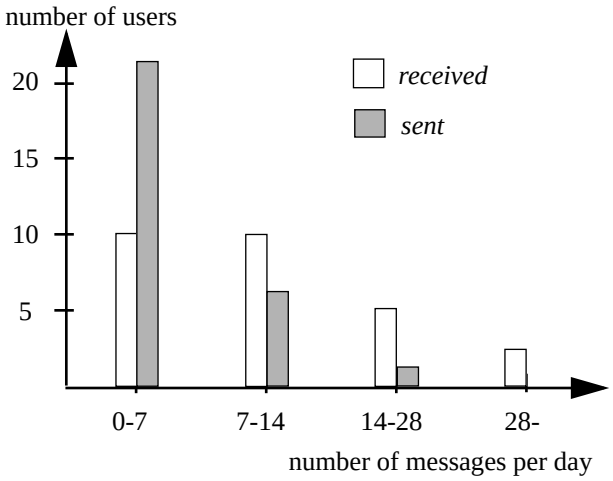


Figure 3.1 Number of received and sent messages a day.

Many email systems have a folder named “inbox” where all incoming messages are stored, unless they are manually moved or deleted. A large number of messages in the inbox may cause problems with overviews. Therefore, we asked:

10. How many messages do you have in your incoming mail box (inbox)?

The result is shown in table 3.5. Most respondents had more messages in their inbox than can be displayed on a computer screen. The inbox contained between 5 and 7235 messages (m410, sd814).

Table 3.1 Number of messages in inbox.

Number of messages	# of users	% users
less than 30	11	39%
30-100	3	10%
100-400	8	29%
400-1600	4	14%
more than 1600	1	3%

3.4.2 General problems in handling email

We asked whether the respondents perceived problems with handling their email in general in a question with six answer alternatives:

12. How can you handle your electronic mail today?

The users were asked to select one of the following six alternatives:

1) To handle my email has never been a problem.
2) I have some problems with my email, but I have not solved them yet.
3) I have had problems with my email, but I have found strategies to handle them.
4) I am close to not being able to handle my email.
5) I am close to not being able to handle my email, despite having tried different strategies.
6) I cannot handle my email.

The six different answers alternatives are reduced in the analysis to: “No problem” (alternatives 1 and 3), “Borderline” (alternatives 4 and 5) and “Problems” (alternatives 2 and 6). The last group is occasionally split into “Problems” and “Severe problems”. The result of question 12 will be used in several of the following sections. The answers are presented in table 3.2.

Table 3.2 Professions at the university site and their level of problems.

Profession	%	No problems	Border-line	Have problems	Severe problems
Researcher/Teacher (9)	32	1	2	4	2
Research student (12)	43	5	0	7	0
Programmer (4)	14	4	0	0	0
Other (3)	11	2	1	0	0
TOTAL (28)	100	12	3	11	2

Inspection of table 3.2 shows a tendency for the Researchers/Teachers to have more (severe) problems than the other groups and for the programmers to have no problems. The programmers may feel more in control of their computers, but their number is too small for statistically significant conclusions. Totally at the university site 43% claimed that they had no problems with email, 46% that they had problems.

In question 14 we asked about situations where problems occur.

14. In which of the following situations have problems occurred (several alternatives possible)?

The answer alternatives were:

_ When I receive information on what to do in my work.
_ When I communicate with others
_ When I order services from others
_ When I want to find relevant information for my work
_ When I exchange documents (text files) with others
_ When I save messages
_ When I try to find saved messages
_ When I try to delete messages
_ Other:

Of these factors, the last three are related to organisation of messages and account for most of the problems: 25% (7 respondents) had problems when saving messages, 43% (12) when searching for messages and 39% (11) when deleting messages.

Another question that is referred to in the following sections is the open ended question 21 with the four most common answers are presented in table 3.3.

21. What are the three major problems that you have with email?

Table 3.3 The four most common problems with email.

Answer	# of respondents	%
Sorting	10	36%
Searching	7	25%
Address retrieval	5	18%
Distorted national characters	4	14%

The problems with regard to sorting (organisation of messages) and searching (finding old messages) is mentioned in Mander et al. (1992), searching in Mackay (1988), and address retrieval in Hjalmarsson et. al. (1989).

The problem of distorted national characters is explained on pages 22-23. A common cause is that computers distribute email messages using 7-bit encoding, and the different character sets used on different computers. For example the Swedish character “Ö” is coded as 153 on a PC, but 133 on a Macintosh. A word as “räksmörgås” (shrimp sandwich), may therefore be distorted to e.g. “r{ksm|rg}s”, “rdksmvrges”, or

even “r=E4ksm=F6rg=E5s”, depending on the computers used to send, transmit, and receive the message.

In a follow-up question via email in 1996 the respondents were asked whether they had perceived problems with handling åääö in the last three months. Of the 27 answers 22 respondents (81%) replied “yes” they had problems. Of the remaining 18% (5 respondents) that replied “no”, two email messages that were used for the question returned with distorted åääö! One native English speaking person replied:

> No, I have no problems, I always write aao instead of åääö

In total, only 7% replied that they perceived no distortion of national characters without contradicting themselves in their reply.

The answer quoted above exposes one of the weaknesses in this study: the interpretation of the word “problem” in question 12 may differ between the respondents. Our intention was that the respondents would state if they perceived any problems with handling the *flow* of email. However, the more specific questions 14 and 21 points out the most important sources of problems with email.

3.4.3 Problems associated with email flow

There was no observed correlation between perceived problems (question 12) and the number of incoming/outgoing messages or the number of messages in inbox. These results confirms those of Mackay (1988). Our extremes were a person with four incoming messages a day who experienced severe problems and a person with 280 incoming messages a day that had never had any problems.

Users inundated with work may have larger problems to control their email. Mackay (1988) describes lack of time as an important factor for the prioritisers’ behaviour in her study. In Lantz (1996) half of the ten interviewed perceived that they did not have enough time to handle their email. Therefore, we asked in the second “Work situation questionnaire” a number of questions about the work situation (W1 and W2). Answers follow in table 3.4:

W1. Do you feel that you have time to do what you should in your work?

Use a scale from 1 to 5, where 1 is no, you do not have time at all and 5 is yes, you have time to do everything.

W2. Are you often stressed and have problems finishing tasks in time?

Use a scale from 1 to 5, where 1 is “always stressed“ and 5 is “never stressed”.

Table 3.4 Grading of work situation.

Question	mean value	standard deviation
W1. Time (5 = have time to do everything)	3.0	1.2
W2. Stressed (5 = never stressed)	3.1	1.0
1-5 scale with 5 as the best grade.		

However, no significant differences could be found between the group that perceived problems and the group that did not. One conclusion is that lack of time was at this site not an important factor for the different problem levels shown in table 3.2. The number of users was not large (twelve and thirteen) in the two groups (those that had problems and those that did not). In retrospect it would have been better to have more respondents, in order to divide them into e.g. different work task groups, but the size of the investigated research laboratory was fixed.

3.4.4 Organisation of email messages

With time, the number of stored email messages grows. Ordinary papers, documents, books, and other paper-based information, may be organised in piles, binders and shelves. Most email programs offer some possibility to organise email messages. These possibilities may be more or less useful. We asked four questions about organising email (question 9 and 11 in the University questionnaire and question 3 and 4 in the Work Situation questionnaire):

9. How do you save the email you receive (several alternatives possible)?

_ All in the same folder.
_ A folder for each month.
_ Sort in folders after subject
_ Sort in folders after sender.
_ Delete everything.
_ Delete all messages after they have been handled.
_ other:

Messages were stored in one folder by 50% (14 respondents), a folder a month by 14% (4), according to subject by 36% (10), according to sender by 18% (5). Some used the "other" alternative and declared that they deleted most of the messages (21%, 6 respondents), or stored selectively in chronological order (14%, 4). The strategy for storing email was not correlated to whether the subjects had problems or not (question 12).

The number of stored messages may affect the users' ability to find stored messages. Therefore we asked in question 11:

11. How many email messages have you saved in different folders or files?

The answers are presented in table 3.5. The respondents had between 25 and 7200 messages stored (m1500). Many users (43%) had more than 1000 messages stored, but there was no significant difference in number of stored messages between those that had problems and those who did not.

Table 3.5 Number of stored messages totally.

Number of stored messages	# of users	% users
less than 100	7	25%
100-1000	9	32%
more than 1000	12	43%

When asked in question 21 what the three major problems with email were, 36% (10 respondents) mentioned sorting, and 25% (7) mentioned searching (see table 3.3). In fact all (13 respondents) of those that said that they perceived problems in general with handling email (question 12) had problems with searching and sorting (question 14 and 21). Of those that did not perceive problems in general a third (4 respondents) mentioned problems with searching and sorting in question 14 or 21.

Address handling

According to Pliskin (1989) and Hjalmarsson et al. (1989) it is important to improve the handling of email addresses in the email programs. The strategy for address retrieval may also affect the possibilities to organise messages. When messages are stored only to keep the email addresses, the mail folder will be used both for storing addresses and messages with an important content. After some time it will be impossible to know which messages are stored because of the address and which are stored because of the contents and the user will have problems overviewing messages. We asked how the respondents handled their addresses:

8. How do you handle email addresses of people that you communicate with (several alternatives are possible)?

The alternatives and answers are presented in table 3.6.

Table 3.6 Handling of email addresses.

Alternative	Percentage
Use old messages.	79%
Use an electronic address book.	25%
Use a paper address book.	18%
Remember the addresses.	32%
Use another program that can search for addresses.	0%
Other	0%
Sum exceeds 100% due to respondents' use of several strategies for address handling	

Those who used paper storage had a tendency to be overrepresented in the group with

problems, 78% of those had problems. Of those who used an electronic address book, 71% also used old messages to retrieve addresses. This implies that the electronic address books may be inadequate. When asked what the three major problems with email were (question 21), 21% claimed that address retrieval was one (see table 3.3).

Organisation of information in general

The ability to organise papers and files in the "real" world might affect the ability to organise messages on the computer. This may affect the number of problems, so we asked in the Work situation questionnaire:

W3. In what kind of order are your paper documents (ordinary paper mail, reports etc.) ?

Use a scale from 1 to 5, where 1 is very bad order (many unidentified piles) and 5 very good order (all piles are possible to identify, everything is sorted in files).

W4. How would you rate the order of your files in the computer? (electronic documents, programs)

Use a scale from 1 to 5, where 1 very bad order and 5 very good order.

The answers are presented in table 3.4 which shows that the respondents in general rated their order of files on the computer higher than the order of paper in the real world. There was, however, no correlation between the respondents' perceived order of their paper documents and their files.

Table 3.7 Perceived level of organisation on files and papers.

Question	mean value	standard deviation
W3. Paper order	3.1	1.2
W4. File order	3.9	0.8
Rating of their paper document and file order by 26 respondents. 1 is very bad order and 5 is very good order.		

In table 3.8 the order of paper documents is compared to the number of email messages. Those that felt that their paper documents were in good order had fewer messages in their inbox and fewer messages saved.

Table 3.8 Correlation between perceived order of paper documents and number of email messages in inbox and saved messages. 95% confidence interval.

Variables	Correlation
Document order vs. # of messages in inbox	-0.6
Document order vs. # of messages saved	-0.8
The correlation indicates that respondents that perceived that their paper documents were in good order had less email messages stored. 26 respondents.	

In table 3.9 the file order is compared to perceived problems in handing email. Those that perceived problems rated their file order lower than those that did not perceive problems (P-value 0.0002). No such differences could be found between perceived problems and the recipients' rating of the order of ordinary paper files in their room.

Table 3.9 Order on files compared to level of problems.

	Mean	Standard deviation
No problems	4.5	0.5
Have problems	3.4	0.7
Rating of file order by 26 respondents, where 1 is very bad order and 5 is very good order. An unpaired t-test gives a P-value of 0.0002.		

The results indicate that users that can organise their files can also control the organisation of email messages. Users that perceive themselves as good organisers in the real world may anyway have problems with organising email messages. This indicates that better support for organising messages could decrease the number of problems perceived by the users. Deleting messages may be one way for good organisers in the real world to handle the organisation in their mailbox.

Finding old messages

For people with many stored messages, finding a certain old message can be difficult. We asked for the respondents' view of the selection possibilities in their mail tool.

18. Do you think that the possibilities to issue select commands (all messages from a certain person, after a certain date) are adequate in your mail tool?

More than half of the users (57%) reported that the possibilities to perform selections were inadequate. This may be one reason why half of the users used only one folder to store their messages in. Some mail tools demand that the user specifies the name of the folder that should be searched. If the user does not know that (which is likely since the message location is unknown), the user must enter the name of one folder after another and restart the search each time. This may cause users to simplify searches by storing all messages in one folder. There were other interfaces available that performed a search in the background and automatically continued in the next folder unless the user specified a folder to search in. For example Eudora had such an interface, but was not used at the time of the study by the respondents.

3.5 Comparison between an industry site and a university site

The study reported on so far is parallel to Lantz' (1995) study of an industrial site. Her email questionnaire concerned heavy users of email and had 58 respondents. The questionnaires contained partly the same questions, so it is possible to compare the industrial and the university site. A more detailed comparison is given in Bälter & Lantz (1995).

Industry site

The industry organisation worked in a high technology area. Two hundred persons in eight work groups received the electronically delivered questionnaire. Totally 58 subjects (53 men and 5 women) answered the questionnaire. According to our contact persons on the work site all these subjects were highly educated and had a high work load. The experience of email varied between a couple of months and thirteen years. Sixty percent of the subjects had used email during the last 3-5 years. A few used email at home. Based on the subjects' own description of their work and work tasks performed they were grouped into the following work categories: constructor (47%), manager (30%), tester (12%) and administrator/writer (11%).

Email handling

The access rate to the email system and the number of incoming and outgoing messages at the industrial site was similar to the usage at the university. However, as shown in table 3.10, the percentage of users at the university site that perceived problems was higher than at the industrial site.

Table 3.10 Respondents experience of how they can handle their mail.

	No problems	Have problems	Have had problems	Borderline	Severe problems
Industry	55%	9%	27%	9%	0%
University	37%	40%	6%	9%	6%

There are several possible explanations why problems were more common at the university site:

1. More external communication at the university site. This often causes national characters to be distorted because of incompatible systems.
2. A greater diversity of computer types were used at the university site.
3. A greater diversity of mail tools were used at the university site.
4. The lower response rate at the industrial site, 29% compared to 88% at the university. When a questionnaire is sent to people via email, the subjects that have problems or severe problems with email may be less inclined to answer than the subjects with no problems. At the university site, reminders were possible to send by paper mail as well.
5. A reluctance to admit problems at the industrial site.

Explanations 1 and 2 were confirmed by the interviews described below. Explanations 3 and 4 were affirmed by the answers in the questionnaires and are displayed in tables 3.11 and 3.12.

Table 3.11 Computer usage at the industry and university site.

	Sun	PC	Macintosh
Industry	100%	10%	5%
University	50%	11%	75%
The sum exceeds 100% due to respondents use of several computer types			

Table 3.12 Mail system usage at the industry and university site.

	Mailtool	mail	MEMO	Mailstrom	MH	other
Industry	74%	26%	26%	-	-	7%
University	14%	36%	-	29%	29%	25%
The sum exceeds 100% due to respondents use of several mail tools. The group “other” at the university consists of 7 users with 5 different email systems.						

Choice of mail tool

In table 3.11 the difference in computer policy at the two sites is illustrated. The university policy was to let users choose computer and mail system. At the industry site most people used Sun and Mailtool as it was company policy.

These differences in computers affect the possible choice of mail tools, as shown in table 3.12. Despite the more homogeneous computer environment at the industry site, 34% used more than one mail system compared to 39% at the university. The industry site had MEMO as the dominating complementary system (26%, 16 subjects). No system dominated at the university.

Storage of messages

As shown in table 3.13, more messages were stored at the university. An explanation might be that email had been used longer at the university, and therefore those users had accumulated more messages.

Table 3.13 Number of stored messages estimated by the users (mean values).

	inbox	other folders
Industry	47	284
University	410	1500

3.6 Interviews

The results of the questionnaire surveys produced some new questions that influenced the choice of subjects for the interviews. It was generally known at the university that the computing facilities group used email a lot, and probably received many more messages than the subjects in the questionnaire survey. In these three groups (industry, university, computer facilities group) almost everyone had a background in computer science or a related technical subject. Non-technical people could have another view of email and its problems. Based on these considerations twelve interviews were made to four different groups of users:

1. Five technically educated people at a university.
2. Three people at the computing facilities group (that have a very high load of incoming messages) at a university.
3. Two technically educated people at a technical company.
4. Two non-technical people at two non-technical sites.

Description of the interviewed email users

The five subjects that were interviewed at the university site participated in the initial survey and were selected to obtain a variety of users with both few and many incoming messages, few and many messages stored, and users of different computers and mail tools.

The three subjects interviewed at the computing facilities group at the university site were responsible for the computers for the 140 people at the Computer Science Department and approximately 5000 students at the university. They worked both with hardware and software and relied heavily on email for communication internally and with students. Several types of computers were used, but no PCs. Many kinds of email programs were used since they often test new programs.

The two users interviewed at the industrial site participated in the study by Lantz (1996). They worked with computers daily, and had a Master's degree in some technical subject.

One of the non-technical staff worked at a medical research institute and assisted researchers when they needed help with computations or their computer programs. Email had been used for a few months at that department. Both PCs and Macintoshes were used with Eudora as the only email program.

The other non-technical person worked at a commercial company, supervising data from product tests. This person also had general responsibility for computers and programs, but no formal computer education. Mostly Macintoshes, but also a few PCs were used at the company. At the time of the interview, four different mail tools were used.

Conclusions from the interviews are illustrated with citations, translated from Swedish. Added parts are placed within [] to provide a context for the citations. The results are divided into three sections: Size of email flow, Organisation of messages, and Users' adaptation.

3.6.1 Size of email flow

In the interviews, the subjects discussed their handling of incoming messages. Four months had passed between the questionnaire survey and the interviews. Most subjects had more messages stored at the time of the interview than before. No one had reduced the number of stored messages. The rate of incoming mail was approximately the same. The users were asked to estimate the number of messages in their inbox and totally. These estimations were then compared to the actual number. All interviewees made accurate estimations. Lantz (1996) reported a correlation of 0.98 between the number of messages in the inbox estimated by the users and the actual number.

In order to control their flow of email, the subjects from the computing facilities mostly wanted support for processing incoming mail fast and deleting:

> I like to use one-character commands. It is extremely important for me that I can process a large number of messages in a short time. Most messages I can delete at once. Of the 2000 messages I receive in a week, 1500 can be deleted directly without any action, but I still want to see them. Even if it's only notifications from some computer that needs attention.

Cleaning the inbox is perceived as essential for some users to feel that they control their email:

> If the inbox grows towards 40 messages then I start to feel sick about it.

3.6.2 Organisation of messages

The interviewees gave suggestions for how they would like to be supported to organise email messages.

> I would like the mail tools to suggest a sorting [of incoming messages] and as I handled each message I would normally accept it, but I would still have a chance to just delete it or put it somewhere else.

An exception were the two non-technical interviewees. They had very few messages stored and used only the inbox to store messages, although the rate of incoming messages was only slightly lower than at the university site. This may be explained by the shorter period of email usage at their sites and therefore fewer stored messages.

Both the possibilities to sort messages and the search possibilities can be improved:

> It is important to be able to sort in different ways. Even when I have a folder for a topic I would like to sort them within that folder.
>
> There should be a way to search that is independent of the folder structure.

The address book must be better than the current alternative:

> I keep a message from all people that I communicate with, even if I know their addresses. It is easier to press r [for reply] than to write the address.

During the interviews, there were both suggestions for improvements and complaints about functionality of the current address book. Two interviewees spontaneously came up with a similar function when asked about the number of stored messages:

> You should have a program that scans through all messages and collects the addresses so that you can [delete the rest].

3.6.3 Users' adaptation

From both the questionnaires and the interviews it is clear that users have problems with email and their mail programs. The presentation of the results of the interviews below is divided into adaptation, consistency, functionality, and help.

Adaptation

The interviews reveal that the user must adapt to the mail program. When people are faced with a problem, they solve it, work around it, or adapt to it. This work-around or adaptation may make people think that they are in control and have no problems with their mail tool, but they do have problems:

> I can only have one folder open at the same time. I would like to have the inbox opened at the same time as I'm reading some other folder to check something out that is related to the message I'm reading.(Q12: Never had problems)

The programmers answered in the questionnaire that they had no problems at all. This may be explained by an unwillingness to admit problems with a computer, but also by their ability to find fast solutions to computer problems:

> There are no problems with searching. I just read the entire mbox file into Emacs and use ordinary Emacs-commands to search for whatever I want. (Q12: Never had problems)

One person did not want to use email from home because of the problems with incompatibilities between the mail tool used at the work site and the one used at home, but did not think of this as a problem:

> When I'm running mail from home, I use Unix mail and then the messages are stored in another way. This means that if I use mail from home I have to take care of that mail box manually to get it into my ordinary tool. (Q12: Never had problems)

Some interviewees simply avoided certain tasks to avoid problems:

> I have avoided problems by not using certain functions that I really would like to have. (Q12: Never had problems)

Consistency

There were annoying consistency problems in the mail tools. For example in Mailtool V3 "close" on a read window closed the window, but "close" on a write window closed the whole application. Another annoying interface mistake in Mailtool V3 was that once a window had been opened to write a new message, the message must be saved. No matter if the user had second thoughts and did not want to write a message, it still had to be saved.

A severe consistency problem is the structure of the mail files that makes it difficult to switch mail programs. This may be one explanation why so many users still used old command based systems. Many mail tools have a unique format for storing email messages. Mail files and address lists cannot be transferred from one tool to another:

> My mail tool has an address book, but I only have one person in it. I was running an older version before and the new one isn't compatible with the last one.

> I wish that the [file and folder] structure I have made could be used, not only for this program, but for other mail tools as well so that you can use the best parts of each program.
>
> I have to discover that the message has an attachment and that I can do with Mailstrom, but once I have opened the message with Mailstrom, then Eudora cannot open it. So I have to send the message again and then very quickly turn off Mailstrom so that Mailstrom does not catch the message again. Then I switch to Eudora and read [the attachment message there]. [It is awkward] but it works.

The program is prioritised higher than the user

As the computer is a tool that should support the user, and not vice versa, the user should be in control of the computer. However, in some cases the user is not allowed to disturb the mail tool:

> It was disrupting [when the mail tool fetched a message every 5 minute], because the computer slows down when it fetches mail.
>
> If I mark a number of messages that should be deleted and delete them, then I have to sit and wait until it's done. I cannot do anything in the meantime.

Inadequate help

Some subjects wrote in their free-text comments in the questionnaires that they did not know how to perform certain operations in their mail tool, even for operations that they had searched for. Others asked for functionality that they already had, but were unaware of. There are manuals and help systems, but there must be something wrong with them when not even computer scientists understand them:

> There is a function for template documents, but I haven't succeeded in making it work. (Computer scientist)
>
> It should be possible to refine a search, but I don't know how to do it. I've seen it done. (Computer facility staff)
>
> I have read the man[ual] page several times, but never managed to make the select command work, except for the simplest cases. (Computer scientist)

3.7 Summary

I have described a study of the use of email in an academic research laboratory with the aim to suggest design improvements to email tools in general. This study is mainly based on a limited material from one site and general conclusions about mail usage should therefore be made with caution. However, a number of observations of problems for email users have been made.

Many users had problems handling email and they had to adapt themselves to their email system. Especially, the possibilities to organise, search, and delete messages could be improved in order to support the users, as well as possibilities to handle national characters and switch between different email systems.

Even the interfaces of modern email programs can be improved. Many of the problems mentioned are related to imperfect interfaces. Results from the interviews on the

users' ability to adapt to their email programs indicate that questionnaires alone are not enough to identify problems in the interface; interviews can clarify contradictions and give a deeper understanding of the users' situation.

Old email systems

Users with thousands of messages stored may be reluctant to switch to a more modern email system with a graphical direct-manipulative interface due to the many different formats used by mail tools and the risk of losing old messages. This may explain the large usage of old mail tools at the university, where more messages were stored.

National characters

The problem of distorted national characters is important outside the English speaking community. These problems can be handled for most languages by international standards, such as Unicode (Unicode 1991, 1992, 1993). For the eight languages and alphabets in the five Nordic countries, see Nordic (1992).

Within an organisation these problems can be avoided when all users have only one computer type and the same mail tool. However, limiting people to certain tools may reduce the technical problems but increase other problems, such as that users feel out of control in the choice of one of the most important tools they use.

Size of email flow

Although no correlation between problems and the number of incoming messages, or the available time could be found, those that received many email messages expressed a need to process messages fast. A large number of stored messages can cause problems with overview; too many messages in the inbox can make the user uncomfortable. These problems can be solved or diminished by better support for *organising*, *searching* and *deleting* messages.

Organisation of messages

Organisation of messages and files was the single most important observed source of problems. Even those that perceived themselves as good organisers in the real world cannot transmit this knowledge to the computer. Although it is possible to organise messages in folders, it might be too difficult or time consuming to move and retrieve the messages. In all mail tools used in this study, messages could be stored in different folders, but none of the tools fully supported drag-and-drop both within the mail tool and between the mail tool and the file system.

The search and sort facilities must also be improved. Most respondents had more messages in their inbox than they could display at a time on their screen. In some cases this was caused by inadequate search facilities in the mail tool that constrained users to store all messages in one folder, in other cases many messages were stored just in order to save the addresses.

Adaptation to the mail tool

The users in this study showed a great capacity for adapting themselves to their mail tool. Some users used other programs to search in the messages when the search func-

tionality in the mail tool was inadequate. Other users simply gave up and avoided problems by not using certain functions or even avoided using email in certain situations. For example they used only one folder, even though they wanted to have several folders, if it was difficult to get an overview of folders or to move messages between the folders. They also avoided reading email from home because the mail formats of the mail tool at work and at home were incompatible. This adaptation concerns all users: even computer scientists demonstrated that they did not understand the manual or the on-line help, instead they adapted to their email program.

Users learn inconsistencies in their mail tools, and between mail tools, and adapt their management of email to the inconsistencies. E.g. users in Sweden write aao instead of åäö when they know or suspect that the receiver will receive those characters distorted.

Interface design defects

Besides the suggestions above of new or improved functionality there were several design defects that the respondents mentioned. In many cases simplicity of programming still has priority over the users' simplicity of usage:

- There is no support for organising email messages spatially today.
- The program is often prioritised higher than the user.
- The users have no control over the flags that mark e.g. read/unread messages.
- There is no support to change from one email tool to another.
- There is no support for using more than one email tool at the same time.

3.8 Conclusions for further studies

With the licentiate thesis as a basis the studies described in the following chapters were performed. The view to study users in order to identify problems with their tools was extended to include their working context. The different views on computers and email usage that non-technical users had compared to the technical users inspired the choice of a non-technical organisation to further investigate this issue. Also, the special situation that the managers in the study above described: many email messages and a large amount of communication, encouraged us to especially study managers. Finally the study raised questions about information overflow, and how email systems can support users in dealing with large amounts of information.

4 Email in a Technical Company

In order to investigate the issues described in chapters 1 and 3: email usage, organisation of email messages, manager's email usage, and information overflow; we searched for a company with a large percentage of experienced email users. We found a company, here named MainframePC, that allowed us to perform a survey and interviews at the company.

Our study comprised a pre-study with interviews, a survey, and a longitudinal case study. An outline of the study is illustrated in figure 4.1. The first section of this chapter states the main purposes of the study. It is followed by a section that describes the studied company and its mainframe email systems. The next section explains the methods used. The results are divided into two sections: the survey and the longitudinal case study. The chapter ends with a summary of the results from the whole study.

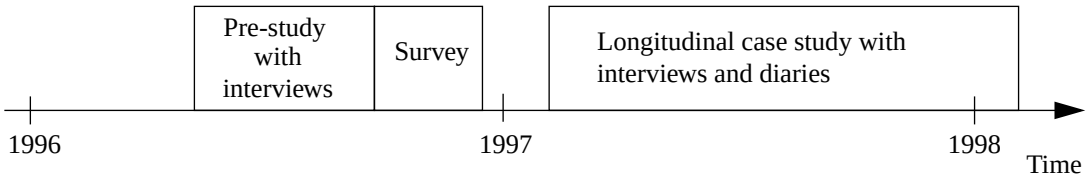


Figure 4.1 Timing of elements in the MainframePC study.

4.1 Purposes of the study

There were four main purposes of this study:

- to examine managers' email communication in the context of other means of communication and their work tasks,
- to investigate the strategies used to organise email messages and the rationale behind them,
- to observe the process of the introduction of a new system for communication that would replace an older system,
- to follow the communication of a few new employees during a year and their development as email users.

4.2 Description of MainframePC

MainframePC's business concept is to provide customised computer solutions ranging from batch jobs such as monthly payment of salaries to development of applications. The company has approximately 600 employees and is mainly located at two sites approximately 120 km (75 miles) apart. One site is in a major city, the other in a country village. The company sites are roughly the same size.

The company has traditionally used mainframe computers, but with the growth of the PC market, the focus of the business has gradually shifted towards personal computers. The backbone of the electronic communication within the company is elec-

tronic mail handled by two different mainframe systems, one at each site, here named MMM (Mainframe Mail system at Main site) and MMC (Mainframe Mail system at Country site). The reason for the use of two systems is that the country site was bought a decade ago and there they continued to use the already established email system (MMC). All employees had access to at least one of the two mainframe mail systems. A substantial number of the employees work mainly or solely with mainframe computers and will do so as long as there are mainframe computers in operation.

Before this survey, a pilot study had been made by the company resulting in the conclusion that Lotus Notes could be a solution to the communication problems at MainframePC. With the growing PC market in mind they decided to use Notes as a common platform for the company's communication. The global mother company had announced a switch to Notes within a year or two. At the time of the study, a few departments had transferred to Notes completely. Individual employees that claimed they needed Notes were allotted a license and the appropriate hardware. A plan was made to provide licences, hardware and servers for the remaining mainframe email users.

In order to interpret the answers to some of the questions in the questionnaire some knowledge of the mainframe email systems used is necessary. The main features that distinguish Notes from the two mainframe-based systems are its the graphical interface, mouse support, drag-and-drop handling of email messages, and the simplicity with which attachments can be added to an email message and opened by the receiver. For those that are familiar with PC-technology Notes can be handled just as any other application. Notes also has functionality for shared databases, but these were used only by a limited number of users at the time for the study. A short description of the mainframe systems follows below.

4.2.1 MMM

MMM is a mainframe-based office system with a command line interface. MMM connected all sites of the global mother company to an intranet with a large number of functions: email, calendar, phone book, bulletin board, travel information (about countries, currencies, hotels, etc.), time reports, printer usage, word processing, drawing tools, and other applications.

Most of these applications were integrated. For example, it was possible to send email with calendar information. The system had mainly been developed in the end of the seventies and beginning of the eighties. At the time of the study, many of the functions above had been replaced, or partly replaced, by window-based versions on a PC, but the mainframe version still had a large number of users. The most widely used parts of MMM at the time of the study were email, the calendar, the phone book, and the bulletin boards.

Bridges existed between MMM and Lotus Notes, but not between MMM and MMC. MMM also had an Internet bridge, but the national characters åäö was replaced with aao for Internet mail. MMM was expected to be in service approximately until the year 2000.

MMM was running in a terminal window on a PC or a mainframe terminal. The

window was black with text in white, green, red, and blue. MMM has a hierarchical menu interface. A mouse could be used only to position the cursor, not to select in menus.

There were some usability problems in MMM. Certain functions that still existed in the menus had been taken out of service. The function keys often changed functions between different windows, for example the same function key could be “close” (close the window and return to the level above) in one window and “exit” (the application) in another. The list of messages could not be displayed at the same time as the list of folders. This caused some users to print out the folder list and tape it on the frame of their terminal.

4.2.2 MMC

MMC was also mainframe-based with a command line interface. MMC connected the country site with most of its customers. The MMC net had several hundred thousand users. From many of the terminals it was possible to connect to one’s own email, regardless of which company the terminal was placed at. Besides email, MMC could only handle electronic bulletin boards. There were more modern versions of MMC available at the time of the study with pull-down menus and mouse support, but these were not used at MainframePC.

MMC had some features absent in MMM: acknowledgement of reception, cancellation of sent messages, and handling of attachments. The acknowledgement of reception made it possible to see which recipients of a message that had opened it (and thereby could be assumed to have read it). Messages that had not been opened could be cancelled and in that case they disappeared from the recipient’s mailbox. The possibility to send attachments in email messages was unknown to many MMC users.

MMC also had some limitations: the number of folders was limited to 16 and the number of stored messages to approximately 400. Names of folders were limited to four characters in length. The MMM version used at MainframePC could not communicate via Internet.

4.3 Methods

The study of MainframePC can be divided into three parts: the pre-study of the company, the questionnaire study, and the longitudinal case study.

4.3.1 Pre-study

In order to gather background information as a basis for a survey a set of initial interviews was made with the group responsible for the introduction of Notes at MainframePC. Six employees were also selected in order to get background information from end-users. These six were selected to achieve as large diversity as possible regarding usage of email system (Notes or one of the mainframe mail systems), position (manager or not) and location (main or country site). During the interviews the respondents were asked what they used their email systems for, which other applications they used, which problems they had encountered regarding their email systems,

and other applications and finally questions about their expectations on the future of computer mediated communication in the company. Those that used Notes were asked why they started using Notes.

The respondents also answered preliminary versions of the questionnaire during the interviews. I also made participatory observations by following internal classes in usage of the mainframe systems and Notes.

Results from interviews with the group responsible for the Notes introduction

Besides the description of the company and its email systems the following results came from the pre-study.

There was an implicit demand that email messages should be read and answered "within a short period of time", but there was no explicit policy existed for which messages should be sent via email or e.g. posted on an electronic bulletin board. This implicit sense was "developed with time" according to one of the interviewed managers.

The employees in general had not had access to the World-Wide Web at the time of the interviews, but the mainframe computers provided access to vast amounts of information in the company's world-wide intranet.

Results from interviews with the six employees

Notes was mainly used as an email system and to read electronic bulletin boards. Few of the respondents used shared databases, with the exception of one department where everyone had transferred to Notes. The usage of other applications varied a great deal between the respondents, but also with time for the same person depending on the project they were involved in. The respondents that had transferred to Notes did this for several different reasons:

- because Notes was new and exciting,
- they knew (or thought) it was only a matter of time before the whole company would transfer,
- they were interested in the shared databases,
- they believed in Notes as a future product for the company.

One of the respondents had started using Notes because the whole department had switched to Notes and had at that time been both curious and hesitant. At the time of the study, this person was positive about Notes and stated that:

> If anyone today took Notes away from me I would lose important information.

Those that did not use Notes were experienced mainframe programmers that did not see any particular advantages with personal computers at all besides the fact that it was a growing market. Personal computers were considered unreliable, prone to downtime, and slow.

Managers often received messages that demanded information that the receiving manager did not have him/herself. This resulted in a new outgoing message that had to be answered before the manager could answer the first message. One manager described three main disadvantages of email:

1. too many messages, especially as a manager,
2. many assume that what is written also becomes read[1],
3. it is difficult to handle subtle distinctions in the language so that the receiver interprets the written words in the intended way.

The two first points illustrate the situation for managers inundated with information. Messages were often sent with carbon copies (cc) to managers “just in case”, despite recommendations to reduce the number of un-necessary copies. Managers used the term “cc-disease” to describe this phenomenon.

There were problems with the bridges between Notes and the mainframe systems. This caused delivery delays, sometimes for several days. Some respondents were frustrated that they did not know which email system the recipient used. Some used only Notes, some used only one of the mainframe systems, others a combination. This resulted in some users sending the same message twice, once in each (available) system to be on the safe side. Others sent an extra message only when they did not hear from the recipient.

Results from communication with other employees

During courses I took at the company I participated in discussions with employees during coffee breaks and lunches. This resulted in the following observations.

The cc-disease could partly be explained by the “SYA” (Save Your Ass)-attitude. The three letter acronym was generally known in the company, and employees often sent messages with cc to managers. If anything went wrong later, the manager became partly responsible since “he/she was informed”.

Email communication outside the company resulted in distortion of åäö to aao.

Some managers complained about the cost for installing Notes and thought that this money should be spent to solve problems with printers that all to often did not work properly.

4.3.2 Questionnaire

The 14 page questionnaire, see appendix A, covered five general topics:

Work situation

Initially the respondents were asked to describe their work tasks and position and also how they shared information with others and what kind of information they shared.

Communication

The communication section contained questions about how often the respondents communicated, with whom, why, and which media they used.

1. Implying that he as a manager had received messages from other people that took for granted that he had time to read their messages.

Computer system

The section regarding computer system asked the respondents what operating systems and applications they used and for what purposes, and also their opinions about these systems and applications.

Email system

The section about email system contained questions about how long they had used email, how they used email, where and when they used it and whom they sent email messages.

Email handling

Finally the respondents were asked how they saved, organised, deleted, and searched among their email messages and how many messages they had stored.

When answering questions about "how often", the respondents were asked to use a scale "never", "a few times a year, quarter, month, or week" and "daily". One fifth of the questions were open-ended. The respondents also had the opportunity to write open-ended comments in connection to all questions. The whole questionnaire is included in appendix A.

Two separate versions of the questionnaire were made, one for the main site and one for the country site, in order to simplify some questions for the respondents. For example question 34: "What percentage of your email is sent to the MainframePC site in x?", where "x" was replaced with the name of the other site. The final questionnaires were sent to 89 randomly selected employees and managers with more than six months of employment at the company, altogether approximately 16% of the staff.

In order to study the managers' situation an additional 27 questionnaires were sent to randomly selected managers. In total, 81 people responded (70%), 81% of all managers and 61% of the employees. In the results section, 4.4, the smaller sample of 59 respondents is used to describe the situation for the company as a whole (named company in tables), but in comparisons between managers and employees, the large sample of 81 respondents is used (named total in tables). In some cases, the differences between managers and employees were insignificant and the larger sample was therefore used also for three other comparisons[1]: organisation of email messages (divided after folder usage and cleaning frequency), email system (Notes, MMM, and MMC), and in the discussion about the importance of users' experience of older email systems when a new one should be introduced.

4.3.3 Longitudinal case study

Shortly after the survey was made, MainframePC decided to halt the roll-out of Notes. There were two reasons for this: the results of the survey that indicated that some of the employees would not use Notes voluntarily and difficulties with a server crucial to the distribution of Notes messages.

1. These comparisons are made under the assumption that there were no significant differences between managers and employees regarding organisation of email messages, email system, and the importance of experience.

This also halted the original plan to study the changes in general between communication in the mainframe systems and Notes. We decided instead to follow a few people more closely during a longer time in order to investigate the changes in and the development of email communication that occur for an individual during a longer period of time. Observing these subjects could also explain some of the issues that the survey had brought up and also give a close-up of the email communication in general after the somewhat failed Notes introduction.

Our wish was to follow five managers, but it was impossible to find managers that could spare the time to participate in the study. Instead, three newly employed persons were selected.

The three employees were interviewed twice for approximately 1.5 to 2 hours. The first interview occurred at the beginning of the study and the second a year later at the end of the study. In the meantime the participants filled in diaries (see appendix B and C) one day every other month. The diaries contained fields for numbers of e.g. email messages, phone calls, and meetings during the day.

4.4 Results of the survey

The results of the survey are presented in the order of the questions in the questionnaire. Here, only the questions relevant for this thesis are described. The questions that are excluded (1, 6-8, 18, 21, 30, 34, 44, 53, 56) regards company specific questions, or questions that would be interesting in a follow-up study after a complete Notes introduction.

4.4.1 Work situation

To achieve an understanding of the communication in the company it is necessary to focus on the context in which the communication takes place. The work tasks and the position influence how a person communicates, with whom, and which media that are used. Therefore we asked:

2. Describe your main work tasks:

and

3. What is your position (several alternatives possible for project managers)?

In table 4.1 the distribution of the respondents' positions is displayed. *Employees* have no personnel or project responsibility. *Project managers* have project responsibility, but no personnel responsibility. *Group managers* have responsibilities for both personnel and projects, but not for other managers. *High ranking managers* have responsibilities for both personnel, projects, and other managers. The two project managers that also were group managers were classified as group managers.

Table 4.1 Respondents' position and managerial responsibility.

	Company (smaller sample)	Total (larger sample)	Part of the group named *managers*	Part of the group named *personnel managers*
High ranking managers	3	6	Yes	Yes
Group managers	8	18	Yes	Yes
Project managers	11	18	Yes	No
Employee	37	39	No	No

Divided by position, the respondents form four groups: employees, project managers, group managers, and high ranking managers. The three manager groups in this study are sometimes joined in one group named managers. The two groups "group managers" and "high ranking managers" are occasionally joined in a group named "Personnel managers" since they have a higher amount of responsibility for the personnel compared to project managers.

The open-ended question 2 was not enough to divide the respondents into work task groups. But in combination with the open-ended question about computer usage (question 18) the respondents were categorised in main work task categories according to table 4.2.

Table 4.2 Respondents' main work tasks.

Work task	Company	Total
Management	19	33
Customer contact	8	10
Mainframe system specialist	10	12
System (PC and/or mainframe) specialist	8	9
PC-system specialist	6	6
Others	8	11

Most of the respondents that were system specialists could be categorised into "Mainframe system specialist" or "PC-system specialist", but due to the open ended questions some system specialists had to be categorised into "System (PC and/or mainframe) specialist"; these respondents could be working with either or both PC and mainframe systems, it was impossible to make a distinction from their answers.

There seems to be a deviation between formal position and perceived main work task. All high ranking managers considered management as their main work task, but only two thirds of the group managers and half of the project managers did so. Also, one employee considered management as his main work task. From table 4.2 it is also clear that a large group of system specialists worked with mainframe computers.

The work situation is heavily dependent on the number of meetings. A person that participates in many meetings has less time in his/her own control. Therefore we asked:

4. How many planned meetings (where a summon has been distributed in advance) do you participate in, on average, each month?

and

5. How much time do these meetings take in total each month?

The answers are presented in table 4.3, divided by position. From table 4.3 it is clear that the average meeting was about two hours and that the number of meetings, and the time spent in meetings increases with rising position. While the employees had on average a meeting once a week, the group and project managers had a meeting every other day and the high ranking managers more than one meeting per day.

Table 4.3 Time spent on planned meetings (mean of hours per day) by the respondents.

Position	Planned meetings/day	
	Time	# of meetings
High ranking manager (n=6)	2.8 h (1.6)	1.3 (0.8)
Group manager (n=18)	1.4 h (0.6)	0.7 (0.4)
Project manager (n=18)	1.1 h (0.6)	0.7 (0.5)
Employee (n=39)	0.4 h (0.3)	0.2 (0.2)
Based on 5 working days a week and 21 working days a month. Standard deviation within parenthesis.		

4.4.2 Communication

An important aspect of work communication is who the respondents communicated with. Therefore we asked:

9. Communication with others is possible in a various number of ways. With whom and how often do you communicate with other people in some way, e.g. via email, letter, fax, telephone, planned or unplanned meetings when you work?

The respondents were asked to select *Never, A few times per year, quarter, month, week,* or *Daily* for five different communication partners: *Colleagues in the group, MainframePC employees outside the group, Customers, Own managers,* and *Employees in the mother company.*

From the results displayed in figure 4.2 it is clear that almost all respondents communicated within their group daily, and more than half of the respondents with other employees within the company daily. The respondents communicated with customers and with managers in median weekly. Communication with the mother company is the category with most diversity. While eight respondents communicated daily with the mother company, thirteen respondents never did. The group “Others” mostly consisted of suppliers (14 of 20 answers).

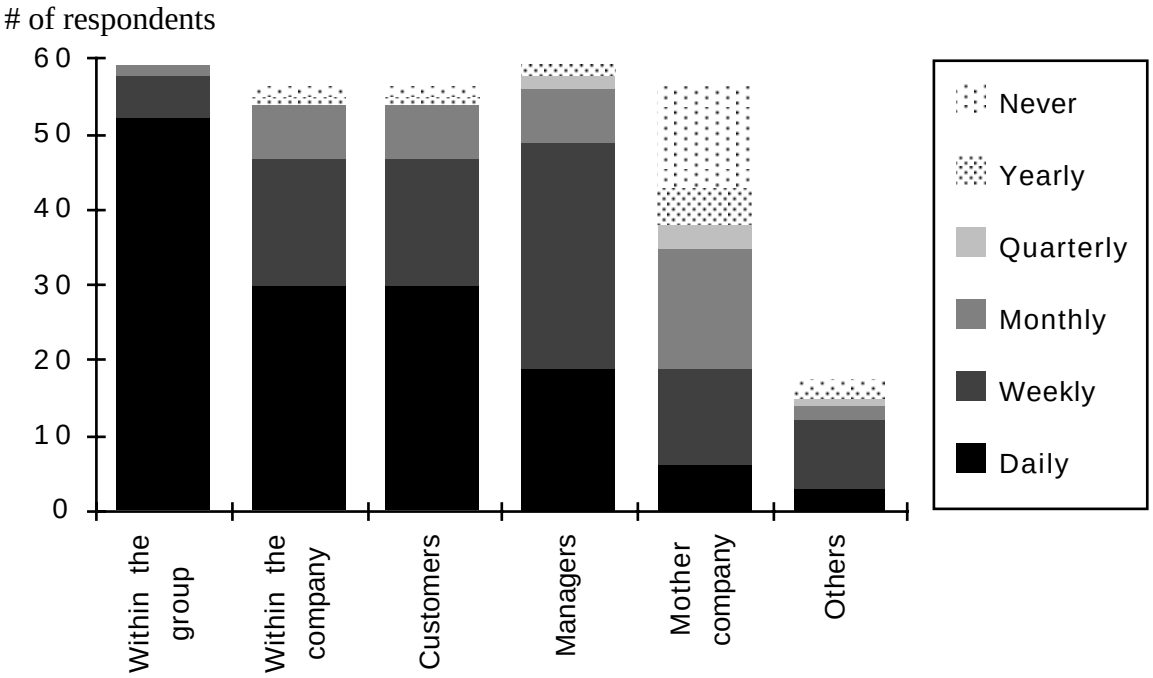


Figure 4.2 Frequency of communication with selected communication partners (n=59). The group Others consisted mainly of suppliers (14 of the 20 answers).

In order to relate email usage to other media, we asked questions about the amount of and time used for email, phone and electronic bulletin boards:

10. How many email messages do you send and receive on average per day (a message sent to several recipients count as one)?

11. How long time on average per day do you use for handling (read, write, organise and delete) email messages (do not include the time to take care of the issues in the messages)?

12. How many phone calls do you have per day on average (incoming and outgoing)?

13. How many minutes on average per day do you spend on these phone calls?

14. How many electronic discussions/bulletin boards do you participate in or read regularly?

15. How much time on average per day do you use for electronic discussions/bulletin boards?

The answers are displayed in table 4.4.

Table 4.4 Time spent on communication via phone, email and planned meetings (mean time) by the respondents.

Position	Email/day			Phone/day		Bulletin boards/day		Planned meetings/ week	
	Time (m)	# of received messages	# of sent messages	Time (m)	# of calls	Time (m)	# of BB	Time (h)	# of meetings
High ranking manager (n=6)	103 (69)	21 (12)	18 (12)	53 (30)	16 (6)	11 (12)	3 (3)	13.6 (7.6)	6.3 (4.1)
Group manager (n=18)	79 (51)	17 (12)	14 (12)	46 (17)	11 (6)	11 (12)	4 (4)	7.0 (3.0)	3.6 (1.8)
Project manager (n=18)	62 (72)	14 (17)	11 (17)	41 (34)	8 (4)	11 (9)	5 (5)	5.4 (3.0)	3.3 (2.3)
Employee (n=39)	35 (29)	8 (8)	5 (5)	52 (58)	12 (12)	13 (17)	5 (5)	1.9 (1.6)	1.1 (0.8)

Standard deviation within parenthesis.

No significant correlation could be detected between position and usage of phone. The increased communication that followed a higher position consisted mostly of email and meetings.

Bair (1979) estimated the average time to read a message to 30 seconds and the time to write a message to 4 minutes. The relation between these two estimates can be used to estimate the time used per message according to:

Time for email per day / (# of received / 9 + # of sent · 8/9)

With this estimate, the average time to handle a message decreases insignificantly with higher position from nine minutes for employees to six minutes for high ranking managers.

Whether the differences in table 4.4 imply that managers at MainframePC were overloaded with information is not clear, but the fact that managers used email and participated in meetings more than employees is unquestionable. A possible explanation is that meetings and email may be more suitable to organise work and to delegate tasks than telephone.

Personnel managers (group managers and high ranking managers) received more email messages than others (project managers and employees, t-test P-value 0.0055), sent more email messages than others (t-test P-value 0.0060), and used more time for email than others (t-test P-value 0.0008). As in earlier studies (e.g. Mackay 1988, Palme 1995a, Bälter 1995, Lantz 1996) the number of sent and received messages were positively correlated; and more messages were received than sent. A former manager with five sent messages and five received a day commented on this in the survey:

When I was an active manager it was 10 [sent] and 60 [received].

Communication is an essential part of work for all employees, and for managers it is the major part, as high ranking managers spent 67 %, group managers 43 %, project

managers 35 % and employees 23 % on email, phone, and planned meetings (based on a 40 hour working week, see table 4.3). The time for unplanned meetings should be added to this, but unfortunately we did not ask for time spent in unplanned meetings. The percentages are similar to earlier studies of managers (Burns 1954; Stewart 1967; Lawrence 1984), which estimated the time spent on communication to between 60 % and 80 % for managers.

4.4.3 Computer and communication systems

The computer system itself affects the usage. Many applications can for example be used only on PCs. A command line based system where the user has to remember and type commands differs from a graphical system where the users can use a mouse to manipulate the interface and only have to recognise commands. Therefore we asked:

16. Which operating systems do you use (have access to does not count, several alternatives possible)?

The answers are displayed in tables 4.5 and 4.6. Although no differences in the operating system used were significant, managers had a tendency to use *more* operating systems (mean 2.7 compared to 2.4, t-test P-value 0.056) due to the managers' use of more PC-operating systems.

Table 4.5 PC operating systems (percentage for each position).

Position	OS/2	Windows 3	Others
High ranking manager (n=6)	50 %	50 %	33 %
Group manager (n=16)	78 %	67 %	0 %
Project manager (n=15)	50 %	33 %	11 %
Employee (n=34)	67 %	69 %	3 %
OS/2 and Windows 3 are PC-operating systems. Others consists of Windows95 (4 respondents) and Windows NT (1 respondent).			

Table 4.6 Mainframe operating systems (percentage for each position).

Position	VM	MVS	Others
High ranking manager (n=6)	50 %	83 %	0 %
Group manager (n=18)	89 %	94 %	6 %
Project manager (n=18)	67 %	56 %	0 %
Employee (n=38)	59 %	72 %	10 %
VM (Virtual Machine) and MVS (Multiple Virtual Storage) are mainframe operating systems. Others consists of AS400 (5 respondents), AIX (1 respondent), and OPC (1 respondent).			

The communication systems were divided geographically. All employees at the main site had access to MMM, all at the country site had access to MMC. At the time of the

study the company expected that 10-20% of the employees had access to Notes. Therefore we asked:

17. Which of these systems do you have access to and use respectively (several alternatives possible)?

The answer alternatives were MMM, MMC, and Notes. The answers are displayed in table 4.7. The number of users that had access to Notes was much higher than expected: 80% of the employees had access to Notes. Explanations to the large difference between the expected amount and the actual amount of Notes users may be that the company did not record who was using which system and that the many users with a technical background (the majority of the employees) were eager to try out the Notes system as it had received a lot of publicity.

Table 4.7 Communication system, number of users at the company.

System	Had access to	% access	Used	% used
MMM	35	59 %	31	52 %
MMC	33	56 %	30	51 %
Lotus Notes	47	80 %	49	63 %

In table 4.7 answers to the same question are given for the larger sample with the extra managers. Only small differences between the two samples can be noted; the following discussion is therefore based on the larger sample.

Table 4.8 Communication system, number of users totally in the study.

System	Had access to	% access	Used	% used
MMM	52	64 %	46	56 %
MMC	42	52 %	38	47 %
Lotus Notes	62	77 %	49	60 %

If the respondents are divided into “Notes-users” and “Others”, certain differences appear: Notes users used more email systems (average 2.0 compared to 1.1, t-test P-value < 0.0001) and participated in twice as many electronic discussions as others (t-test P-value 0.074), see question 14. Notes users claimed that they used more PC operating systems (mean 1.3 compared to 0.8, t-test P-value < 0.0001). This may be caused by the work tasks, that for some meant several operating systems. All groups used the same number of mainframe operating systems.

Notes users received and sent less messages than others (10 received messages a day compared to 16, t-test P-value 0.026, 7 sent messages a day compared to 13, t-test P-value 0.028). No differences in work tasks between these groups could be detected. One explanation may be that Notes offered more diversified possibilities for tasks that must be solved via email in the other systems, such as the shared databases. But the cause(s) may be far more complicated. The number of incoming and outgoing messages may be related to how many users the system has. Since Notes was fairly new in the company, some users were uncertain whether all recipients of a message used

Notes or only had access to it.

From table 4.7 it is also clear that Notes was the system that most respondents had access to, but also the system with the largest percentage of non-users among those that had access to it. More than a fifth, or 21%, of those that had access to Notes did not use it, compared to 12% for MMM and 8% for MMC.

In table 4.9, the same answers are displayed divided by position. From the table it is clear that Notes had non-users in all positions.

Table 4.9 Communication systems, access and usage.

Position	MMM		MMC		Notes	
	Had	Used	Had	Used	Had	Used
High ranking manager (n=6)	3	3	3	3	5	3
Group manager (n=20)	16	14	7	7	16	13
Project manager (n=16)	11	11	7	7	13	10
Employee (n=39)	22	18	25	21	28	23
Number of users that stated they had access to (had) or used (used) the three main communication systems.						

Against the background of the approaching Notes-introduction, it was important to identify advantages and disadvantages with the old mainframe systems. This was handled in two open ended questions (19 and 20). The questionnaire was distributed in two different versions, one to the main site where questions where formulated with “MMM” and one to the country site where the same questions were formulated with MMC. These questions are formulated MMM/MMC here.

19. What are the greatest advantages with MMM/MMC for you?

The most common answers are displayed in table 4.10 and table 4.11.

Table 4.10 Main advantages with MMM according to the respondents.

Access everywhere	Everybody uses MMM	Fast	Reliable	Rich functionality
31 %	26 %	24 %	21 %	17 %
Percentage of 42 users answering the question about advantages with MMM.				

“Access everywhere” in table 4.10 refers to MMM possibilities to access one’s own email at all sites of the global mother company. “Rich functionality” refers to the many applications integrated with MMM mentioned above.

The advantages of MMC mentioned in the open ended questions are displayed in table 4.11. Besides writing these advantages, as many as 45% stated “none” as the disadvantage of MMC, half of those were Notes users.

Table 4.11 Main advantages with MMC according to the respondents.

Fast	Reaches customers	Easy to use	Everybody uses/ can be reached by MMC	Confirmed reading of messages
39 %	21 %	21 %	18 %	15 %
Percentage of 33 users answering the question about advantages with MMC.				

Two of the alternatives in table 4.11 may need an explanation. MMC was used by many of the country site's customers, which simplified communication, and MMC users also had possibilities to access their own email at the customers' sites. MMC kept a record of all recipients that had opened a message. This feature was appreciated especially by a respondent in the pre-study who distributed general information and summons to meetings.

Some features in the older systems could not be matched by Notes. Subjects working mainly with mainframes had already, via the mainframe mail system and news groups, access to a global net of peers – a gold mine for finding solutions to problems in their daily work.

> If I have a problem with [the mainframe system], I post a message in [news group] and the same day, or next day, I may have 20 suggestions to solutions from all over the world.

20. What are the greatest disadvantages with MMM/MMC for you?

The four most commonly mentioned disadvantages of the mainframe mail system at the main site (MMM) are displayed in table 4.12.

Table 4.12 Main disadvantages of MMM according to the respondents.

Bad interface	Inconsistent function keys	Attachments are complicated	Old word processor
27 %	17 %	15 %	12 %
Percentages of 41 users answering the question about MMM disadvantages.			

The most common disadvantages mentioned in the open ended questions about MMC are displayed in table 4.13.

Table 4.13 Main disadvantages of MMC according to the respondents.

Old word processor	Bad/old interface, lacking functionality	Bad/no integration with other tools
15 %	12 %	9 %
Percentages of 33 users answering the question about MMC disadvantages.		

Both MMM and MMC users complained about the word processor, maybe because they were used to modern word processors such as AmiPro. MMC was not integrated with other tools. No-one complained about MMM's lack of integration with other

tools. One explanation may be that MMM contained applications such as calendar, phone book, and possibilities for travel arrangements. Many of these applications were integrated with the email system and MMM users may have had less needs to use other tools.

Notes is marketed with the argument that it should be easy to develop new applications with Notes databases as a base. In order to compare the respondents' attitudes towards suggesting new applications we asked:

22. How many new computer applications, small and large, have you suggested during the last year (regardless whether they have been implemented or not)?

Thirty-eight respondents had suggested at least one application during the last year. The number of applications suggested can be affected by several factors, e.g. the influence a person have over an actual implementation. Managers with personnel responsibilities stated that they had in average suggested 4 applications during the last year, compared to 2.6 for others, but the difference was not significant. Notes users suggested four times as many applications as others (t-test P-value 0.035).

4.4.4 Email usage

The usage of email may be affected by the experience a person has of email and this may be a source of differences between users. The experience may affect the way email is used and the number of incoming, outgoing and stored messages. Therefore we asked:

23. How long have you been using email (MMM, MMC or some other mail system)?

The mean value was 10 years. 91% of the respondents had more than four years of experience. As shown in table 4.14 managers had only slightly longer experience of email (t-test P-value 0.0053) than the employees. .

Table 4.14 Email experience (mean value in years).

Position	Experience	Standard deviation
High ranking manager (n=6)	13 years	6.1
Group manager (n=18)	11 years	4.2
Project manager (n=16)	12 years	3.1
Employee (n=39)	9 years	4.9

The access frequency, that is the number of occasions per day a user checks her email can indicate how important email is for her communication. Therefore we asked how often the respondents checked their email with the alternatives:

24. How often do you check your email?

- ❑ Less often than once a week.
- ❑ Once a week.
- ❑ Several times a week.
- ❑ At some occasion during the day.
- ❑ Several times a day.
- ❑ Continuously, incoming email may interrupt other tasks.
- ❑ Other way: _____

The answers are displayed in table 4.15. The table uncovers that 93% checked their email several times a day, and that all but one checked email daily. Half of the respondents allowed incoming email messages to interrupt on-going tasks. There were no statistically significant differences between managers and employees. The conclusion is that email was a very important communication tool within the company.

Table 4.15 Access frequency for email systems.

	# of respondents	% respondents
Several times a week	1	1 %
Some occasion during the day	5	6 %
Several times a day	34	43 %
Continuously, incoming email may interrupt other tasks	40	50 %

Notes is also marketed with the argument that it can handle attachments smoothly. Therefore we asked:

25. How large amount of the email messages that you send contain information created with other programs than the email program (e.g. word processor, drawing tool)?

and

26. How does it work to send information created with other programs in email messages? Please grade on a scale from one to five, where one is very poor and five is very good.

The answers to question 25 is displayed in table 4.16, and the answers to question 26 in table 4.17. On average the respondents reported that they sent attachments in 6.7% of their messages, with large individual differences. One person sent attachments in 90% of the messages, two in 50%, and the rest in less than 30%. Half of the respondents never sent attachments.

Table 4.16 Frequency of sending email messages with attachments , divided by sender's work task.

Work task (numbers for the company versus the whole population)	Attachments (average %)	
	Company	Totally
Management (18 vs 32)	10 %	7 %
Mainframe system (9 vs 11)	2 %	4 %
Customer contact (8 vs 10)	5 %	4 %
System (PC and/or mainframe) (8 vs 9)	23 %	21 %
PC-system (6 vs 6)	5 %	5 %
Others (8 vs 11)	5 %	5 %
Total	9 %	7%

When it comes to grading the possibilities to send attachments, there were some differences, though not statistically significant. Mainframe programmers graded MMM higher than others and PC-programmers rated Notes higher. In general, Notes outscored the mainframe mail systems, as displayed in table 4.17.

Table 4.17 Grading of possibilities to send attachments.

MMM (n=29)	MMC (n=10)	Notes (n=27)
2.8 (1.5)	2.3 (1.7)	4.2 (0.97)
Mean values. Standard deviation within parenthesis. 1-5 scale, with 5 as the best grade.		

Notes' more modern interface and integration with other tools seems to facilitate the usage of attachments, but 12 of 29 MMM users graded MMM as 4 or higher. For MMC the corresponding numbers was 3 of 10. One conclusion is that the knowledge of the possibilities to send attachments and how this was done in the mainframe systems varied among the respondents.

In the pre-study the respondents mentioned problems related to the connections between the different mail systems. This caused messages to be delayed, sometimes for several days. Therefore we asked:

27. How often do you get email delayed for technical reasons?

Notes users suffered delays more often that others (when grouped into those that had problems weekly or more often and monthly or more seldom, Chi^2-test (1 df) = 9.8, P-value < 0.005). None of the non-Notes users had problems weekly, compared to 26 % of the Notes users.

Another way of measuring the importance of email, besides the access frequency in question 24, is the need to access email at other places than the ordinary workplace. Therefore we asked:

28. How often do you have a need to read your email at other sites than your ordinary workplace?

and

29. Do you use email via a modem? If so, please state where (several alternatives possible):

Personnel managers claimed a greater need to read their email at other places than their ordinary workplace compared to project managers and employees. Divided into weekly or more often a Chi^2-test (1 df) = 11.1 gives a P-value < 0.001.

Of the 46 respondents (56%) that used modems all but one used it at home (85% solely at home). Of the Personnel managers, 83% used modems compared to 50% for others. There was a tendency for modem users to have a need to access their email more often than others (t-test P-value 0.064). The need to access email at other places may also be solved by other means: the two mainframe mail systems both gave possibilities to access email from other offices in the global mother company or at customers' sites.

Another problem with handling email messages at MainframePC was the cc-disease described in the pre-study. Advice had been distributed within the company to limit the number of carbon copies, but without a major impact. In this company the cc-problem may partly be explained by the SYA (Save Your Ass)-attitude. Also, there was no spoken policy for what messages should be distributed via email or via an electronic bulletin board. The feeling for this was "developed by time", as one manager expressed it during an interview. In order to examine the frequency of this phenomenon we asked:

31. What percentage of your email are you the sole recipient of?

32. What percentage of your incoming email are information that you really do not want to read (e.g. unneccesary carbon copies (cc), information that arrives too soon or too late)?

33. What percentage of your incoming email would, according to your opinion, be better to distribute in another way (e.g. via an electronical bulletin board)?

The answers are presented in table 4.18.

Table 4.18 Percentage of different types of email.

Position	Sole recipient (%)	Unnecessary (%)	Distribute in another way (%)
High ranking manager (n=6)	43 %	20 %	14 % (n=5)
Group manager (n=19)	42 %	11 % (n=18)	6 % (n=13)
Project manager (n=16)	48 %	12 %	11 % (n=11)
Employee (n=39)	53 %	12 %	10 % (n=26)

If these unwanted messages did not exist, how much time would the receiver save? The answers give a possibility to estimate an upper limit of potential time savings by

eliminating the unwanted/unnecessary email messages. If the numbers in table 4.18 are independent, and the time to handle an incoming message is one eighth of an outgoing message (Bair 1979) then only six people in this study would save more than five minutes a day. The person that would save most would save 19 minutes. However, uninteresting messages probably take shorter time than average to handle, so the time saved is probably less. The conclusion is that this is not an efficient way to save time. On the other hand, even 5 minutes a day can be perceived as valuable time for certain people, and the cognitive load of being overloaded with the *wrong* tasks may make the effort to reduce these messages worth some consideration.

Filtering rules in the email tool may be used to decrease the overload, but filtering rules also demand time to learn and to construct. Also, filtering may cause problems with awareness of what is going on in the company and what kind of information has arrived. In the study reported in Bälter (1995) some users wanted incoming messages to be stored directly into folders, whereas others wanted this sorting only to be a suggestion for where to store the message after reading it.

In order to get a picture of the communication outside the company we asked:

35. What percentage of your email is sent to recipients outside MainframePC?

The answers are presented in table 4.19. In general the communication with email outside the company was rather limited, but certain individuals reported that they sent 95% of their messages to recipients outside the company. Managers had a tendency to send a larger percent of their messages outside the company, both domestic and abroad (t-test P-value 0.098). This may indicate a more complex work situation.

Table 4.19 Percentage of messages outside the company.

Recipients outside the company	Company percentage (n=57)	Totally percentage (n=79)	Managers percentage (n=41)	Employees percentage (n=38)
To MMC-users	7.2 %	6.5 %	4.8 %	8.3 %
To MMM-users (e.g. mother company)	12.1 %	14.4 %	15.9 %	12.9 %
Domestic	5.6 %	5.0 %	2.5 %	7.7 %
International	2.2 %	2.5 %	3.6 %	1.4 %

4.4.5 Email handling

At MainframePC there was no policy for how large documents should be distributed via email. Messages that were a part of a dialogue were sent back and forth with comments and new questions added. These messages could sometimes become very long and time-consuming to read. Therefore we asked:

36. Some email messages can take a long time to handle. How long do you normally keep email messages before they are completely handled, in other words: how long is your backlog?

and

37. How long does it normally take for your colleagues to answer email messages that you send before you get an answer, in other words: how long are your colleagues' backlogs on average?

The answers are presented in table 4.20. For the respondents' own backlog the time is once again increasing with higher position. The differences between Personnel managers and others yield a t-test P-value of 0.061. Backlog can be difficult to estimate, but there are several reasons for why managers should have a longer backlog. Managers often have a high workload (Wright 1996), that can prevent them from answering messages immediately. The pre-study uncovered a problem that automatically prolongs managers backlog: Managers receive messages from superiors that demand information that the manager does not have personally. The manager then must ask one or several employees for the information, and may have to wait for their answers.

Table 4.20 Backlog.

Position	Backlog (own)	Backlog (others)
High ranking manager (n=6)	3.7 days	2.4 days
Group manager (n=18)	2.2 days	2.7 days (n=17)
Project manager (n=15)	1.9 days	2.4 days
Employee (n=37)	1.6 days	2.0 days (n=34)

One manager explained backlog problems during an interview:

> There exists an unspoken expectation that email messages that do not demand an investigation should be answered within a few hours, and those that do within a few days. For those that are in a supervising position and delegate tasks these messages are very important to discover among the others. Everybody attempts to find their own strategy to survive.

Folder usage

The strategies for storing email messages vary a great deal. Some save all messages in order to be able to search among them, which can be a smooth way to keep track of all steps in a dialogue. Others delete all messages immediately after reading them. Between these extremes there is a scale of variation of storing and deleting messages. Therefore we asked:

38. How large amount of your incoming email messages do you store initially?

The answers are displayed in table 4.21. From the table it is possible to divide users into three categories: those that stored everything (23%), those that stored certain (47%) and those who deleted most or all of their messages (30%).

Table 4.21 Storing of incoming messages.

Method	Company		Totally	
	# of respon-dents	%	# of respon-dents	%
Store everything	12	21	18	23
Store certain messages	26	46	36	47
Deletes most messages after handling	12	21	16	21
Delete everything after handling	3	5	4	5
Others (save some and deletes most)	3	5	3	4

The reasons why respondents stored email messages was examined by the next question:

39. Why do you store email messages? State with an approximate percentage. The sum does not have to be 100%.

with the answer alternatives:

To be certain of what has been said/written. _____ %.

The messages contain information that I probably will need in the future _____ %.

I store messages that I probably will not have any use for in the future. _____ %.

I use email messages as a “to do” list. _____ %.

Other: _____ _____ %.

The answers are displayed in table 4.22. From this table and the previous one it is clear that email was used by a majority to store information, not only to send messages. There is a difference between those that delete most of their messages and the others. Those that delete most of their messages (answer alternative 3 and 4 to question 38) store a smaller percentage that they probably do not need (answer alternative 3 to question 39, t-test P-value 0.021).

Table 4.22 Reasons for storing incoming messages.

Reason	Company %	Totally %
Be certain of what has been said (n=74)	31	37
Messages contain facts needed later (n=74)	48	46
Save messages that I probably do not need (n=72)	10	10
Use messages as a to-do list (n=71)	10	11

The number of stored messages is also an indicator of the function and importance of email for an individual’s work tasks. Many stored messages in folders may indicate

that the messages are used as an information source during a long period of time. Many messages in the inbox may suggest problems with handling the incoming messages. Therefore we asked:

40. How many email messages do you normally have in the inbox (un-categorised in Notes)?

41. How many email messages do you have stored in total?

45. How many folders/categories do you have totally today?

46. How many of your folders/categories are of no use to you currently?

The answers are displayed in table 4.23 divided by email system. From the table it is clear that MMM users had more messages stored and more folders, which is natural since MMM had been in use much longer than Notes. The numbers for MMC, however, is approximately the same as for Notes. This may be explained by the limitations of number of messages and folders in MMC. However, there are other interesting connections described below.

There is a correlation of 0.9 for the number of messages in inbox in MMC and Notes for the ten users that used both systems. One explanation may be that the MMC users have transferred their old habits to the new system.

If we divide the respondents into "folder users" (more than 4 folders totally[1]) and others, a Chi^2-test (1 df) shows that those who had access to MMM were inclined to use more folders (Chi^2 (1 df)=13.51, P-value <0.0005). Those that received many messages also stored many messages and used many folders. The correlation between the number of incoming email messages per day and the number of folders and saved messages was 0.7 and 0.4 respectively, both with a 99% confidence interval. Only MMM users had more than 30 folders.

Table 4.23 Mean values for stored messages (standard deviation within parenthesis).

Email system	Number of email messages		Number of folders	
	in inbox	totally	totally	unused
MMM	45 (50) (n=42)	1135 (1420) (n=36)	94 (214) (n=36)	23 (33) (n=29)
MMC	71 (95) (n=29)	183 (230) (n=14)	9 (5) (n=11)	1 (2) (n=11)
Notes	20 (30) (n=32)	102 (122) (n=25)	9 (9) (n=27)	1 (2) (n=24)

The respondents' answers to questions about size of the email flow, how often they accessed their mail tool and electronic bulletin boards indicate that folder users were using email and other computer based messaging systems more intensely than others: they received more messages (mean 15 a day, compared to 9, t-test P-value 0.028), accessed their email system more often (continuously, compared to several times a day), and read more electronic bulletin boards (mean 5.8 a day, compared to 2.5, t-test

1. More than four folders totally results in more than two folders in at least one of the systems or more than one in at least two of the systems. This indicates that the user have to chose between folders.

P-value 0.0021). The folder usage did not affect the time spent per message[1]; no statistically significant differences could be found.

Folder users more often had a need to read email at other places than their original work place (mean every other day, compared to once a week, t-test P-value 0.017), despite the fact that there was no correlation between the number of incoming messages and the frequency of this need. They also sent a larger percentage messages abroad (mean 3.8 a day, compared to 0.4, t-test P-value 0.084). No differences could be detected regarding folder usage between managers and employees. Folder usage was more common among those that were categorised as “system specialists” and “others” (see table 4.2, Chi^2 (1 df)=8.57, P-value <0.005).

The tool may affect the choice of folder usage, the MMC users were less likely to use folders (Chi^2 (1 df)=18.7, P-value <0.001). An explanation may be that MMC has a maximum limit of the number of both messages and folders; this forces the users to use fewer folders.

We also asked the respondents about outgoing messages:

42. What percentage do you store of the outgoing messages?

43. Where do you store the messages that you send?

These habits did not differ between the users of different mail tools. On average the 55 respondents to this question stored 52% of the outgoing messages. More than one quarter (27%) of the respondents stored more than 90%, only three respondents (5%) did not store any outgoing messages at all. A separate folder for these outgoing messages was slightly more common than storing outgoing messages together with incoming messages (55% vs 40%). A small group (6%) used a combination.

Sorting messages

Sorting messages into folders has been shown to be a problem (see e.g. Lantz 1996; Bälter 1995). Therefore we asked:

47. How often do you have problems with sorting/categorising incoming messages?

48. Please give examples of your problems with sorting/categorising incoming messages.

Of the 51 respondents that used folders, 21 reported problems categorising email messages. Half of the folder users never had problems, but a third had problems at least monthly.

The reported problems with categorising email messages were: 1 Message belongs to several folders (9 respondents), 2 Finding the appropriate folder (5), 3 No/unclear strategy for classification (4), 4 Disk space shortage (2), and 5 Sub-folders not visible (1).

1. With time per message calculated according to the description on page 83.

Cleaning habits

Cleaning mail folders consists of two parts: deleting messages and moving messages. Deleting messages simplifies searching among the remaining messages and some users clean their mailboxes to get a sense of well-being (Bälter 1995). However, deleting messages is not always an advantage: the user must make a choice for each message whether to delete it or not. Also, messages can be deleted by mistake, or deleted for perfect reasons at the time, but then other things change and the deleted message ought to be retrieved after all. Moving messages, normally from the inbox to other folders, have the same effect as cleaning, with the advantage that messages still can be retrieved and the disadvantage that the size of the mail folders is not reduced. Therefore we asked:

49. How often do you do clean-ups (delete old email messages, sort messages in folders/categories) normally?

The answers are displayed in table 4.24. The causes behind the cleaning frequency are complex. No correlation could be detected with the number of incoming messages, stored messages, folders, or messages in the inbox.

Table 4.24 Cleaning frequency.

Frequency	Company (n=58)		Totally (n=80)		Managers (n=41)		Employees (n=39)	
	# of users	%	# of users	%	# of users	%	# of users	%
Never	1	2 %	1	1 %	0	0 %	1	3 %
Yearly	11	19 %	12	16 %	6	15 %	7	18 %
Quarterly	13	22 %	16	21 %	9	22 %	8	21 %
Monthly	14	24 %	24	32 %	17	41 %	9	23 %
Weekly	11	19 %	11	15 %	4	10 %	8	21 %
Daily	8	14 %	11	15 %	5	12 %	6	15 %

Cleaning habits may not be the choice of the user as some systems limit the users' disk space and force users to delete messages. In this study, respondents that cleaned at least weekly were categorised as "cleaners". On average this group cleaned their mailboxes nearly once a day, the others once a month. Cleaners spent less time on email (mean 35 minutes a day, compared to 64 for the non-cleaners, t-test P-value 0.028), perhaps due to their tendency to send fewer messages (mean 4 a day, compared to 11, t-test P-value 0.060). They also received slightly fewer messages than non-cleaners, but the difference was insignificant (mean 9.3 a day, compared to 13.7, t-test P-value 0.15).

As expected, cleaners saved a larger percentage of their messages to store information (mean 62 %, compared to 40 %, t-test P-value 0.0087). They also had a tendency to store a smaller percentage of their messages "just in case" (mean 4 %, compared to

12 % for those that cleaned seldom, t-test P-value 0.097).

Again, the strategy is related to the mail tool: MMC users were more likely to clean often (Chi^2 (1 df)=6.4, P-value <0.05), and they also had fewer messages in their inbox (mean 30, compared to 108, t-test P-value 0.026). Once again, the maximum limit of the number of messages and folders in MMC may force the users to clean more frequently.

Those that used only MMM cleaned more seldom (Chi^2 (1 df)=9.4, P-value <0.005). This is more difficult to explain, but one reason may be that in MMM new messages were added to the top of the message list, compared to the bottom in the other tools. The message window was by default displaying the top of the message list. This "top adding" may facilitate for users to ignore older messages, since there is no need for scrolling down a long list to find the new messages.

An idea for functionality that could support the deletion of messages came up during the studies described in the previous chapter. We were interested in the respondents' view of such functionality and asked:

50. Would you appreciate if your messages were stored temporarily in a waste basket for e.g. a month when you have deleted the messages, so that you in a case of emergency would be able to retrieve deleted messages during this period? Please grade on a scale from one to five, where one is no use and five is very useful.

The automatic waste basket achieved an average of 2.6 (sd 1.5). One third of the respondents graded the waste basket four or higher.

Searching for messages

It is generally known that many users store a large number of messages, but are these stored messages used? In order to investigate this we asked:

51. How often do you search among old stored messages?

52. How do you search among stored messages (several alternatives possible)?

The answers are displayed in table 4.25 and table 4.26.

Table 4.25 Search frequency among stored messages.

Search frequency	# of respondents	% respondents	# of stored messages	s.d.
Never	7	1 %	14	13
Yearly	2	16 %	210	230
Quarterly	8	21 %	290	350
Monthly	20	32 %	290	330
Weekly	33	15 %	940	1300
Daily	7	15 %	1600	1800

Since folders are used to archive messages for subsequent usage, the folder users were expected to search for messages more often, and this study supports this hypothesis: Folder users searched for their archived messages in median weekly, compared to

monthly for the others. Divided into those who searched at least weekly a Chi^2-test (1 df) gives a P-value <0.025.

Table 4.26 Search method among stored messages.

Search method	# of respondents	% respond-ents	# of stored messages	s.d.
Manually	43	61 %	520	830
Search tool	10	14 %	1300	1700
Manually and search tool	10	14 %	940	1500
Other method	7	10 %	770	1100

The mean values suggest, as expected, that there was a correlation between the number of stored messages and the number of searches among these messages. The correlation was 0.3, with a 97.5 % confidence interval. Also, those that searched manually had fewer messages compared to those that searched with a tool. Cleaning may affect the possibilities to search manually among the messages, but search tools were used by cleaners as often as by no-cleaners, neither did cleaning affect the time spent per message (as described on page 83); no statistically significant differences could be found.

4.4.6 Expectations on Lotus Notes

Finally we asked two questions about Notes. Due to the expected Notes usage of 10-20% in the company, the questions are formulated as speculations. However, all answers but 11 came from respondents that had access to Notes.

54. What do you think are the advantages of Lotus Notes?

The disadvantages mentioned of the mainframe mail systems were often the same as the advantages mentioned of Notes, as displayed in table 4.27. The answers to this question indicates that the respondents' mainly viewed Notes as an email system. Besides the possibilities to share data mentioned in table 4.27, few respondents made remarks about Notes' groupware qualities.

Table 4.27 Notes main advantages according to the respondents.

Nice integration with other tools	User friendly, easy to use	Possibilities to share data	Modern/good word processor
28 %	25 %	18 %	8 %
Percentages of 65 response to the question "What do you think are the advantages of Notes?"			

Besides the advantages mentioned in table 4.27, those that had access to Notes had a tendency to send more attachments created by programs other than the mail program (mean 8.3% compared to 1.8% for the non-Notes users, t-test P-value 0.087).

Notes' interface and the capability to share data may have influenced Notes users to read twice as many electronic bulletin boards regularly (the results were six compared to three, t-test P-value 0.074). However, whether this was caused by Notes, or users with these needs switched to Notes cannot be determined from this study.

55. What do you think are the disadvantages of Lotus Notes?

Notes was PC-based at MainframePC and this made the respondents report some disadvantages compared to the mainframe systems. The PC-system had a reputation of breaking down more often than the mainframe systems and breakdowns in the LAN were repaired only during office hours.

Other disadvantages mentioned in the open ended questions are shown in table 4.28. Notes demanded a costly upgrade of the PCs. Some thought this money should be spent on other, more important, needs. The bridges between Notes and the mainframe systems had a history of delaying messages, sometimes for days.

Table 4.28 Main disadvantages with Notes according to the respondents.

Unreliable	Inferior bridges	Demands better PC	Does not reach customers	No access at other offices
34%	16%	9%	7%	4%
Percentages of 66 responds to the question “What do you think are the disadvantages of Notes?”				

In general those that used Notes were very pleased with its functionality and interface. The un-popularity of MMM compared to Notes is illustrated by a comment from a Notes user in the survey.

> If I was forced to use MMM I would quit my job.

4.4.7 Cross examination of answers

When the answers to some of the questions above are combined, two new interesting perspectives surface regarding organisation of email messages and the respondents that did not want to use Notes.

Organisation of email messages

Based on cleaning habits (question 49) and folder usage (question 45 and 46) it is possible to divide the respondents in four strategy groups. Subjects that had more than four useful folders were categorised as “folder users”, those that cleaned among their messages at least weekly were categorised “clean often”. The limit “four” is a compromise between the average of 6.8 useful folders among the No filers in Whittaker & Sidner (1996) and “two” where the problems with deciding which folder to use begins. The distribution is displayed in table 4.29.

Table 4.29 Strategies based on usage of folders and frequency of cleaning.

	Folder users	Few/No folders
Clean often	Frequent filer 10	Folderless cleaner 13
Clean occasionally	Spring cleaner 37	Folderless spring cleaner 20

Managers were more likely to use folders, but the differences were insignificant with one exception: Folderless cleaners were less likely to be managers (Chi^2 (1 df)=3.9, P-

value 0.05). No other significant difference could be found in the choice of strategy based on position (table 4.1) or main work task (table 4.2).

In table 4.30 the data for own backlog and number of email messages are presented. No significant difference could be found between the different strategies regarding the backlog. Further comments on the number of messages follows below.

Table 4.30 Backlog and message flow.

Strategy	Own backlog (days)	Incoming messages per day	Messages sent per day
Frequent filer	2.0	12.3	7.5
Spring cleaner	2.3	15.8	12.5
Folderless cleaner	1.7	6.8	3.6
Folderless spring cleaner	1.5	9.8	7.8

Frequent filers

Frequent filers are cleaners that use folders. The small number of Frequent filers in this study (10) makes it difficult to identify characteristic features, but as expected their habit was delete messages frequently to reduce the percentage of messages saved "just in case" (mean 1.7 %, compared to 13.6 % for the Spring cleaners, t-test P-value 0.049). The influence from the mail tool seems clear: All Frequent filers used Notes. Notes' modern interface may facilitate folder usage and deleting messages compared to the older mainframe mail tools.

Folderless cleaners

Folderless cleaners are cleaners that do not use folders. The cleaning decreases the size of the inbox, where Folderless cleaners had a mean of 18 messages, compared to 64 for others (t-test P-value 0.05).

This strategy may be optimal for a limited usage of email. A third of the Folderless cleaners had an experience shorter than 6 years, compared to less than a tenth of the others. They were also less likely to be managers and handled fewer messages than others (mean 9 a day received and sent, compared to 24, t-test P-value 0.049). Also, all other categories of users claimed that they accessed the mail tool continuously as median, while the Folderless cleaners accessed their mail tool several times a day, a subtle but important difference. One explanation may be the fewer incoming messages. Folderless cleaners had a tendency to spend more time per message (estimated as described on page 83, mean 11 minutes, compared to 7, t-test P-value 0.059). This may partly be explained by the shorter experience with email – the Folderless cleaners do not handle their email flow at the same pace as more experienced users.

Again, the strategy is closely related to the tool: all Folderless cleaners but one used MMC (Chi^2 (1 df)=9.1, P-value <0.005). The maximum limit of messages and folders in MMC may force users to clean more frequently and use fewer folders. Also, this strategy may be suitable for new email users.

Spring cleaners

Spring cleaners are folder users that clean more seldomly than once a week. Spring cleaners are characterised by an extensive use of email: they sent more messages than others (mean 12 a day, compared to 6.7, t-test P-value 0.039), used more time for email (mean 73 minutes a day, compared to 40, t-test P-value 0.0055), and had a greater need to use email at other sites than their main work site (mean every other day, compared to once a week, t-test P-value 0.023).

Spring cleaners' extensive use of email is related to the number of incoming messages addressed to the receiver only. Spring cleaners received a smaller percentage of these messages (mean 34, compared to 63, t-test P-value < 0.0001).

Once again, the choice of strategy is related to the choice of mail tool: Spring cleaners were more likely to use MMM (Chi^2 (1 df)=13.2, P-value <0.001), and less likely to use MMC (Chi^2 (1 df)=18.2, P-value <0.001), and Notes (Chi^2 (1 df)=4.0, P-value <0.05). MMM was mandatory at the main site, MMC at the country site. Notes was the only tool that respondents could chose to use or not, one of the Mainframe systems was mandatory, but as Notes was presented at MainframePC the choice was to start to use it now or later.

The reasons for the Spring cleaners' behaviour may be complex, but for MMM users, as stated before, one reason may be that new messages arrive "on top" of older messages and facilitates a Spring cleaner ignoring older messages that a Frequent filer would have deleted. MMC users have their limited number of folders, and many Notes users must scroll through a list of messages to reach the new items at the bottom (the order is user tailorable, but this option was the default at MainframePC).

Folderless spring cleaners

Folderless spring cleaners do not use folders, and clean less often than once a week. It seems that these users are forced to clean partly due to the limited disk space. Several comments in connection to the cleaning question in the survey mentioned the disk space as a reason:

> Yearly, or when the disk is full.

This group is similar to the "No Filers" in Whittaker & Sidner (1996), but the only statistically significant characteristic in this study was that they were more inclined to use MMC (Chi^2 (1 df)=5.7, P-value <0.025). Yet again, the maximum limit of folders in MMC forces users to use fewer folders. Also, the smaller number of incoming messages (compared to the Spring cleaners) allows these users to ignore cleaning for a longer time, until the MMC maximum limit of messages is reached.

Boycotters

Was Notes used as intended at MainframePC? Notes was promoted as a tool for communication, collaboration, coordination, and central access of data (Lotus 1996). Evidently the employees of MainframePC used Notes to communicate. Collaboration and coordination were not investigated in this study at MainframePC. The function as a central access point to data is illustrated by a quote from the interviews:

> Comparing MMC to Notes is unfair. Those who do not have access to Notes today miss vast amounts of information. Nowadays, I begin each day by browsing through the most important shared databases. I read only the subject line on most of the messages, but after this morning survey I feel informed about what is happening at MainframePC, and the mother company. I do not want to go back to the old system with loose paper notes, and excessive use of the copying machine.

In those parts investigated in this study, Notes was used as intended and was appreciated by many of its users. But would Notes solve all problems? If the two users that mentioned in the survey that they recently had started using Notes are removed from the data set and the usage of Notes is divided by work tasks, it is clear that all respondents that had access to Notes, but did not use it belonged to one of the three work task groups “management”, “mainframe developer” or “system developer” (see table 4.2 for a list of work tasks at MainframePC), as displayed in table 4.31. No differences between the respondents that had access to Notes, but did not use it, and others could be detected regarding sex, position in the company, or years of email experience.

Table 4.31 Respondents main work task and number of respondents that had access to Notes, but did not use it.

Work task	Respondents	Of which had access to Notes, but did not use it.
Management	32	6
Mainframe development	11	4
System development (PC and/or mainframe)	9	1

This might be explained by the short usage of Notes: more than the two people removed from the data set above that had access to Notes may have had that for only a short period of time, and therefore not started to use it yet. This is, however, contradictory to the fact that users voluntarily applied to use Notes and were allotted a license if they had a need of Notes. A better explanation could be that Notes was not useful enough for these non-users. This group that had access to Notes, but did not use it, is here named *Boycotters* and they showed some distinct characteristics that separated them from other users.

Boycotter data

The Boycotters were sole recipients of a third of their email compared to more than half for the others (t-test P-value 0.022). When asked how large percentage of their incoming email that was un-necessary to read, they answered 19 % compared to 12 % for the others (t-test P-value 0.024). When asked what percentage of their incoming email that would be better to distribute in another way, the Boycotters answered with an average of 19 % compared to 8 % for the others (t-test P-value 0.0051).

The Boycotters attached information created outside the email program to their messages more often than the others (2.7 times a day compared to 0.4 for the others, t-test P-value 0.0061) and sent a larger percentage of their messages abroad (6.3 % com-

pared to 2 %, t-test P-value 0.02). Nothing of this could be explained by a lack of functionality or usability in Notes for these tasks: the grading of the capability in Notes to send attachments were higher than for the other systems and external email was sent in the same way in Notes and MMM. The Boycotters had a tendency to grade the capability to send attachments in MMM higher than others (3.7 compared to 2.5, t-test P-value 0.086).

The Boycotters had a tendency to keep a longer backlog of their email than the Notes users (3 days compared to 1.9, t-test P-value 0.099). The longer backlog might have been caused by the work situation for the Boycotters that might not have allowed quicker responses to incoming messages.

The number of incoming email messages for the two work tasks that have Boycotters are displayed in table 4.32. The difference between number of incoming messages for management Boycotters and others in management is significant (middle row in table 4.32, t-test P-value 0.023). There was a tendency, though not reaching significance, towards a difference in the number of incoming messages between management Boycotters and mainframe developer Boycotters (middle column in table 4.32, t-test P-value 0.08). This indicates that the Boycotters were not a homogeneous group, and that they might have had different reasons to boycott Notes.

Table 4.32 Number of incoming messages a day.

Work task	Boycotters	Others
Management	24	12
Mainframe development	9	11

To summarise, the Boycotters were busy people that had a more diversified email communication than others. They probably mastered their old system since they knew how to attach documents to their email messages, a task that many users of the mainframe systems found complicated. The Boycotters did not see Notes as a solution to their problems, maybe because they already knew how to handle the functionality they had use for in the mainframe mail system. Another factor may have been that the time they would need to spend on learning Notes was not available.

4.5 Results from the longitudinal case study

As a follow-up of the survey, I followed a small group of employees more closely for a year in a longitudinal case study.

4.5.1 Subjects and methods

Three newly employed persons were selected by our contact person at MainframePC. These employees were interviewed in the spring of 1997. In the first interview the respondents were asked about:

- background and education,
- experience and usage of email, computers in general and specific applications,
- positive and negative experiences of email and computers,
- Internet and Web usage,
- what kinds of planned meetings they had and how these were affected by their email usage,
- usage of email, fax, paper messages,
- usage of email carbon copies and their communication with their manager,
- handling of email messages (reading, deleting, archiving, retrieving),
- response times, information and communication overflow,
- work place communication in general.

The second interview in the spring of 1998 concerned the same areas as the first with the exclusion of background information and addition of respondents' comments to the development of the diaries (see below). All interviews were made by me personally and all but one were tape-recorded. The second interview contained the same questions as the first with the exception of the background information and addition of comments on the development of the diaries. All interviews lasted between one and two hours.

The interviews were made according to the description in Patton (1980) of informal interviews with open ended questions. The interviews were made by following minutes with questions. Follow-up questions were asked in order to make the respondents elaborate certain answers further. When the respondents "jumped ahead" in the interview protocol, they were asked the questions related to their description and then went back to the original order in the protocol. The results from all these interviews are described in section 4.5.2.

Between these interviews the respondents filled in diaries approximately one day every other month. The diaries are a form where the participants fill in the number of email messages, phone conversations, meetings, etc. during one day. Example of diaries are given in appendix B and C. The results from the diaries were used as a base for discussions during the second interview and are woven into the results described in section 4.5.2. The possibility of obtaining exact data about the email communication from log files was rejected by the company for integrity reasons. A schematic diagram over the studies is presented in figure 4.3.

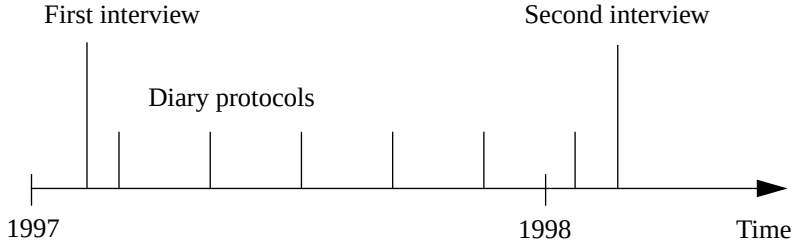


Figure 4.3 Timing of elements in the MainframePC longitudinal case study.

4.5.2 Results from the interviews

The results from the interviews are divided into twelve different areas: Subjects' background and work tasks, Email usage, Email system diversity, Carbon copies, Organisation of email messages, Interruptions, Information overflow, Phone usage, Meetings, Written communication, Web usage, and Computer knowledge. The boundaries between these areas are not sharp, there are overlaps in some cases. The descriptions of the results are illustrated by quotation from the interviews. These quotations are translated from Swedish and sometimes modifications are added within brackets [] in order to clarify. Italics in these quotations are emphasis made by the respondents.

Subjects' background and work tasks

Background data on the three subjects are displayed in table 4.33.

Table 4.33 Background data on the longitudinal case study respondents at the beginning of the study.

	Age	Education	Employment at MFPC	Email experience	Computer experience
Adam	26	University	6 months	2 years	2.5 years
Cecilia	23	University	6 months	3.5 years	7 years
Dennis	42	High school	1 year	17 years	19 years

The two younger subjects, here named Adam and Cecilia, were in their twenties and had two to three years of computer-related education at university level. They had both started at MainframePC directly after leaving the university. The third subject, here named Dennis, was in his forties and had a technical high school education and a long working experience of computer hardware and software.

At the time of the first interview they had been employed by MainframePC for between six to twelve months and they all worked mainly with system development. Dennis was also responsible for some customers' computer systems.

Adam and Cecilia had two to three years experience of email, while Dennis had used email for 17 years. None of them had used Notes before they started their employment at MainframePC. At the beginning of the study Adam and Cecilia mainly used Notes, but also had to use MMM sometimes for company related information. Dennis did not use Notes at all at the beginning of the study. One reason was that he could read Notes only at his PC.

> You have to sit at exactly this PC because here is my identification file. I cannot jump in on any terminal I want to. It is very frustrating. (Dennis)

At the end of the study he used Notes GNA[1] to get Internet access and to be able to handle attachments.

The respondents were asked during the interviews to make a diagram of the people

1. Notes GNA is a version of Notes with Internet access.

they communicated with, by any means of communication, at work. Adam's two diagrams, at the beginning and end of the study respectively, in figures 4.4 and 4.5 may serve as an example for all three respondents. The two diagrams have been re-drawn by me on a computer and the text has been changed to secure the anonymity of the respondent, but the size of objects and their position are a close to the original diagrams. The changes between the respondents' two diagrams are extensive. None of the groups in the first diagram exists in the second besides the own project group and the aspirant group that is a part of the private friends in the second diagram. These changes may serve as an illustration of the changes in communication partners that a new employee experiences in the beginning.

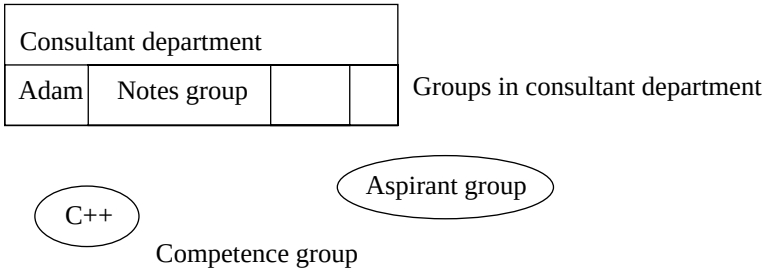


Figure 4.4 Diagram of communication partners at the beginning of the study.

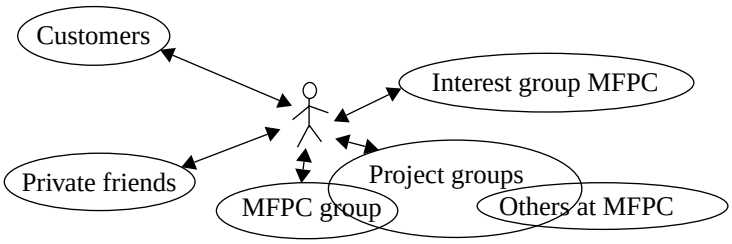


Figure 4.5 Diagram of communication partners at the end of the study.

Email usage

Adam and Cecilia claimed during the first interview that they used email rather extensively while Dennis used email as little as possible and mainly replied to incoming messages. They received on average 5, 15, and 7 email messages a day respectively."

The main advantages of email communication were according to the subjects the ease of getting in touch with people and handling short messages. Adam and Cecilia used email also to stay in touch with their friends. Email was also used for non-work related information within the company: funny stories unrelated to the company circulated among the employees. Cecilia worked at the time of the second interview as a consultant placed at another company and appreciated the speed of email due to the time pressure she had.

They all answered email messages as soon as possible and checked their email several times a day in the system they used most. In the other systems they checked their email between a few times a week to once every three months. At the beginning of this study Dennis checked his email less than once a day, but at the time of the second interview he checked his email in MMM and MMC several times a day, and in Notes a few times per week.

Dennis had used email more extensively before and at that time he stored and organised email messages. He mentioned some reasons why he avoided email at the time of the study: MMM was “a step ten years back in time” and he also complained that it takes time to formulate one’s thoughts in writing, and therefore he preferred to use telephone for almost all conversations.

Dennis thought that many people were addicted to email and could not remember anything in a conversation without asking someone to send an email with the same question or answer again.

> This is a slow organisation so sometimes you have to send [an email] to someone in order to get something done. (Dennis)

Adam communicated with his friends mainly via email, and email was very important for him to maintain his social relations.

> The main reason that phone is used so little for private communication is that most people you communicate with use email instead.
>
> Q: Why?
>
> Because then you can handle it when you have time and the receiver can read it when he has time. I have many acquaintances in my business area, that is have very much to do. They can be difficult to reach via phone and then you try... It is easier to handle that communication via email. If you have to talk to someone on the phone, you do that in the evening so that you know that you can reach him.
>
> Q: What would happen if you could not use email for private communication?
>
> Then you would have to phone these people instead <laughter>. I suppose. Is there something that you have to handle during the day, then you have to call that person.
>
> Q: Would it make you spend less time with your friends if you could not use email?
>
> Yes, there are certain relations that would be easy to lose if you did not have email. Those that live far away or are difficult to reach. When you do not speak to each other every day on phone, but often have contact via email. It is rather important.

None of the respondents knew anything about any goals for the email usage at MainframePC. Adam felt that this was a problem.

> You do not have any demands that you should work with Notes, improve the information flow, they [the management] have not decided and that affects everything, how you communicate, since you do not reach everybody in the same way.

Email system diversity

The situation with three email systems described in section 4.4 has degraded during the study. At the time of the first interview, Adam and Cecilia used Notes (and MMM occasionally) while Dennis used MMM. At the time of the second interview a MainframePC employee may have to use four different systems: MMM, MMC, Notes, and Notes GNA. MMC also appeared in two main versions: the old internal version at MainframePC and a newer version installed at many of MainframePC's customers. This gave some employees Internet access when they were working at customers' sites, but not at their own work site at the company.

The respondents explained that the hope that Notes would become the common communication platform had not come true. There were still many employees that did not use Notes at all, and at every project start there was a discussion where the people involved in the project tried to find a common solution for communication within the project group, which often was MMM or MMC if the project group involved a large number of people.

Cecilia had problems making others understand that she had changed email system from Notes to MMC. It was unclear to all respondents whether it was possible to send email between the different systems and how this was done. The uncertainty about who was using which system has not disappeared during the study.

> In many cases it is possible to send email between almost all systems, but it is not always so easy to know how to do it. In some cases it is impossible to know whether a message actually reaches the destination.

Carbon copies

At the beginning of the study the respondents claimed that they did not use carbon copies (cc) at all or only occasionally, but at the end all respondents used carbon copies regularly. The respondents described three different reasons for using carbon copies:

- to make people do what they should do,
- to keep people informed,
- to keep their own back free.

Dennis had the opinion that too many people sent carbon copies just to show others, mainly their managers, what they were doing. Adam and Cecilia both used carbon copies to managers in order to make other people do what they should.

> They often get an extra push if they know that their manager knows that they are supposed to do this. Many people use it [cc] in that way. You notice that there are certain people that always use that when there is something that they want others to do for them.

Cecilia was aware that it was possible in MMC to see which receivers that had opened a message and claimed that they had an effect similar to carbon copies.

> You get a pressure to do certain things that you think are tricky[1].

Organisation of email messages

Dennis did not store any email messages at all during the study, and had the opinion that other people stored too much and sorted messages "all day long".

> They can save enormous amounts of messages, but you have no use for it. After a while you do not know that you have stored it.

Cecilia did not use folders at the beginning of this study due to a computer breakdown that ruined her email structure. All messages were intact, but all folders were gone. She created nine new folders shortly after the first interview. These 9 folders increased to 19 in six months with a growth of 40 messages a week, when she was placed at a customer's site and had to use MMC instead of Notes. She found it too complicated to use folders in MMC, and due to a three months absence from Notes, the Notes structure became impossible to maintain. Cecilia expressed that she missed the possibilities in Notes to organise her messages. She had at the end of the study around 300 messages in her MMC inbox, but claimed that she knew the content of every message. A vast majority of these messages were private messages that she did not want to delete. In Notes she had more than 1500 messages stored. She claimed that almost all of the messages stored in Notes could be deleted, but there were some messages that she wanted to keep. The reason that she did not delete any of these 1500 messages was that she did not have any time to browse through them and separate the useless from the useful.

Adam used between nine and eleven folders and maintained his structure carefully. He deleted messages and folders frequently and reported that his folder structure evolved with time. Initially his number of stored messages increased slowly, but two months after the first interview the number stabilised at around 300 messages. Occasionally he created a folder where he stored a single message, but often he deleted that folder when he discovered that he had only one message in it. There were a few of his stored messages that he returned to frequently, while the other messages were rarely opened at all.

Interruptions

Dennis did not allow incoming email to interrupt other tasks at the time of the first interview. At the time of the second interview, all respondents allowed incoming email messages to interrupt other tasks. However, they did not always get a signal when a new message arrived, it depended on the application they used at the moment. Adam and Cecilia usually took a quick glance to see if it was an important message. Private messages were handled with a low priority.

> I check the mail at least two times per hour! But if I have sent an important message, [that I expect an answer to] I check more often. (Cecilia)

1. She also explained that work tasks that were not time-consuming had a tendency to be done first. Tasks that were time-consuming and tasks that she did not know how to do often had to wait.

Information overflow

All respondents reported that they occasionally experienced information overflow via email and paper mail, but there were no changes in the information overflow during the study. However, the respondents reported differences in their flow, or their complaints about it. According to Dennis there was no problem handling this overflow, he just deleted carbon copies regarding for example the anniversaries of people that he did not know.

Adam claimed that it was not increases in the information flow that caused the overflow, but the amount of time that other tasks demanded. He was a target for advertisements since he sometimes posted messages in newsgroups.

> When you have posted a message in a newsgroup, then and some weeks forward there usually comes a lot of waste. After a month it usually dries up to a message every other week.

Normally he read the incoming messages even though he was inundated with them, but he down-prioritised replying to messages, even though the pressure to reply still was imminent.

> I do not think that people always expect a fast reply. That pressure is more on me, because I know that if I send a message I appreciate when people answer. Still it can be that I do not have the time to do it. It is the pressure you put on yourself. I prefer to answer the messages I get. You can feel that they expect to get an answer.

Cecilia had experienced lack of information and was therefore reluctant to regard information overflow as a problem. For her it was mainly paper mail that caused information overflow and people making small talk. This was the only reference to communication overflow among the respondents.

> It would really be important to read them, but there is no time to read all these paper messages that you get, that are advertisements for MainframePC. These magazines they distribute, I never read them! I do not have the time! Who should pay for the time? In that case I would have to read them in my spare time. I do not have that much spare time that I could use to sit here and read them.

During the first interview, Cecilia described how she deliberately developed personal relations with help runners (employees that solved problems reported to the help desk) in order to be able to get help, outside the standard procedure to notify the help desk that assigned a person to the problem. This may be regarded as a reaction from Cecilia to communication overflow for the help runners. Cecilia solved this problem by bypassing the official procedures to get help.

The diversity of mail systems also increases the problems with information overflow when partly the same information arrives in different places. But not all information appeared in all systems so all systems had to be checked anyhow.

> It is so mixed, information that is important to me is mixed with information that does not affect me at all through the same channels. It is very difficult to filter out the information that really concerns me among all those things [messages] that do not concern me.

Phone usage

There were no changes in phone usage during the study. Dennis preferred the phone for all types of conversations and had 14 calls a day on average. Adam and Cecilia used phone only for urgent tasks and to develop contacts and had on average 5 and 11 calls per day respectively. One of the main reasons for their resistance to use the phone was the courtesies that occur in phone conversations that takes valuable time.

> It is much faster to write "can I sign you out from this program?" than to phone them and "hello, how are you?" – in that case you have to be polite first and then... [handle the issue] (Cecilia)

Both Adam and Cecilia regarded phone calls as more urgent than email messages, but still they often replied to non-urgent email messages before they returned phone calls. One explanation was that the topic of the phone call was unknown.

> You do not always know what it is about, and that makes it easier to forget [to return the call]. That is it increases the possibility that you do not answer, because you do not know what it is all about. (Cecilia)

Meetings

None of the respondents had the opinion that the usage of email had affected their meetings during the study even though there was room for improvements.

> Often you would like to have more detailed agendas before the meetings. But unfortunately it is not like that, but it could affect the meetings more. The reason is probably the way that email is used [with the diversity of email systems that make distribution complicated]. (Adam)

Written communication

This study was made during the same time as the study described in chapter 5. In that study several respondents mentioned that they had difficulties with writing. During the second interview I therefore asked the respondents in this study to describe their abilities to handle written communication.

Neither Adam nor Cecilia considered writing as a problem, but Dennis admitted that he had difficulties expressing himself in writing. Adam used the text formatting possibilities in Notes less at the end of the study compared to the beginning. Fax and paper mail were used infrequently by the respondents, on average less than one fax or paper mail every other day.

Web usage

MainframePC's attitude towards the World Wide Web has changed during the study. In the beginning the employees had to apply for Web access, which the new employees did, but at the end of the study Web access was a part of the standard installation for new employees. At the time of the first interview Adam and Cecilia had access to the Web, but not Dennis. At the time of the second interview Cecilia did not have access to the Web but both Dennis and Adam used it to fetch information and programs. Adam was at the time of the second interview working in a Web project and used the Web more than half the workday. Although the Web was considered as an important source

for information, there were difficulties with finding the information and the Web also added to the problems with information overflow.

> Now you have... three different places to search for information and one would be enough to have difficulties to search. Now it is more than three times as hard to find [information]. (Adam)

Computer knowledge

All respondents reported that they knew enough about computers and email to handle their work tasks. This attitude did not change during the study. When asked what they did when they had problems with their email program they described how they handled different types of problems and breakdowns. Often they tried to solve the problems on their own. At the same time they were aware that there is always more to learn.

> I usually say about people that think they know everything, that they really know nothing. (Cecilia)

4.6 Summary of the study of the technical company

I have presented a study of a technical company where all employees had access to, and used, electronic mail for communication. The main purposes of the study was to investigate managers usage of email, different strategies for organising email messages, and the development of a few employees email usage during a year. The methods used were a survey based on interviews and a questionnaire with 81 respondents (70%), and recurrent interviews and diaries among three employees during a year.

As always there is a risk that those that did not answer were very busy people and therefore did not have the time to answer. Those that did not answer the survey were reminded by phone about it. The phone answers from those that, in spite of the reminders, did not send any answers to the survey are summarised in table 4.34.

The largest group of those that did not answer the survey was those that also were impossible to reach by phone. This may be caused by an extreme work condition, or that they were outplaced at customers' sites. Those that claimed that they had lost the survey were of course sent a new copy.

Table 4.34 Reasons not to answer the survey.

Reason	# of non-responders	% of missing surveys
Un-reachable	14	40%
Lost the survey	7	20%
Do not want to, or cannot, answer	7	20%
Had no time to answer	4	11%
Promised to answer	3	9%

The results may not be valid for other work sites, but may serve as a description of an organisation that is about to change from an older email system to a newer version or a new email system. This will be useful for other organisations in a similar situation. The fact that all employees used email makes the account of the managers' situation at MainframePC interesting. The great impact of the mail tools on users' organisation of email messages is interesting from a design perspective, and the similarities with the findings in Whittaker & Sidner (1996) gives some validity to the possibility to generalise the observations.

Managers' usage of email

Managers' usage of email was examined only in the survey. The results of the survey shows similarities with other studies (Burns 1954; Stewart 1967; Kotter 1982; Lawrence 1984) regarding the amount of time that managers spent on communication. Besides the fact that managers communicated more than their employees, they also used more operating systems. Managers spent more time on email and in planned meetings than the employees, while the time spent on phone conversations was approximately the same for all categories of respondents. The structure of the information flow with managers functioning as a relay prolonged the backlog for managers. Their email communication was also more complicated as they had a tendency to send a larger amount of messages outside the company.

The "cc-disease", when managers receive carbon copies of email messages that they do not want or need, was a problem for some managers at MainframePC. Based on the results of this study the actual time saved by eliminating these unwanted messages would be more than 5 minutes a day only for six respondents. However, the major improvement for these respondents may be of a cognitive dimension by not being disturbed by the wrong tasks. The new employees in the longitudinal case study increased their usage of carbon copies during the study. Two of them regularly sent carbon copies to managers in order to make other people do what they should and to keep their own back free (the strategy was named SYA, Save Your Ass, in the company).

Information and communication overflow

Information and communication overflow was examined in the longitudinal case study only. The cc-disease mentioned above is related to the problem of information overflow. The respondents in the longitudinal case study occasionally experienced information overflow, mainly from the internal newsletters and magazines that the company distributed. However, the problem with information overflow is complex. One of the respondents had experienced lack of information and considered that worse than the overflow. The problems related to overflow seem to be of two different kinds: the temporary overflow that occurs when a person has too many things to do and the permanent overflow of information that never becomes handled. They have different causes, but the same symptom: a negative feeling of stress related to lack of time to handle this information.

Communication overflow was not considered a problem for the respondents in the

longitudinal case study, but one of them described problems with communication overflow for the help runners. They were busy people and the official way to contact them was through the help desk. However, since the waiting times normally were long, personal relations with these help runners could short-cut the waiting line.

While one of the respondents in the longitudinal case study mentioned that he had problems formulating himself in writing and therefore used the phone as much as possible, the other two avoided the phone when they could as they did not want to waste time on the courtesies that occur in phone conversations.

Email usage and organisation of email messages

Incoming email was given high priority. Half of the respondents in the survey allowed these messages to interrupt other tasks. There were no differences between managers and employees in this respect.

Two thirds of the respondents in the survey used email messages to store information. Especially in one of the mainframe mail systems that had been used for a long time the number of stored messages was large, on average more than 1100 messages. In the other mainframe mail system the number of stored messages was limited by the design and the average was less than 190. Notes had not been used for very long which may explain that the average was as low as 100 stored messages.

When the respondents in the survey are grouped after folder usage and cleaning habits, as suggested by Whittaker and Sidner (1996), significant differences in usage appear as displayed in table 4.35.

Table 4.35 Storing strategies and their main causes.

Strategy	Typical profile
Frequent filer	Intense email user. Uses Notes.
Spring cleaner	Relies heavily on email. Uses MMM.
Folderless cleaner	Limited email usage. Uses MMC.
Folderless spring cleaner	Uses MMC.

A cause-response relationship is difficult to establish, but one connection is obvious. The upper limit of messages and folders in MMC clearly limits the folder usage and also the users' habit to store messages.

Although one of the respondents in the longitudinal case study, Dennis, argued that some email users become addicted and "store messages all day long", there were correlations between the number of stored messages and the search frequency: those that had more messages stored searched more often among these messages. But Dennis has a point: many of the stored messages are not used and could possibly be deleted if there was an efficient way to do that. The search frequency among the respondents was not high, and if the median search frequency (weekly) is applied to the number of stored messages it would take more than ten years for a user with 500 stored messages, to search once for each message. Apparently, only a part of these stored messages are used.

Development as email users

The three respondents in the longitudinal case study were experienced email users already at the beginning of the study, but still their were some changes in email usage during the study.

Adam's reported two changes: he used Notes' formatting possibilities less at the end of the study, and his usage of carbon copies had increased from occasionally to regularly for certain tasks.

Cecilia started to use folders to organise her messages early in the study, but then she had to switch from Notes to MMC and did not use the folder possibilities in MMC. Her usage of carbon copies changed in the same way as Adam's.

Dennis used email only occasionally in the beginning of the study, but in the end he used three email systems. He still mainly replied to email messages and only occasionally initiated email conversations. In the beginning he was reluctant to Notes, but when the new Notes version with Internet access came he started to use it in order to handle attachments.

4.7 What went wrong with the introduction?

The conclusions and implications from all studies in this thesis are described in chapter 7. In this section an analysis of the failed introduction is made, although failure or success of the installation was not the main issue of my study. In order to discuss this failure I will present research regarding installations and introductions of CSCW and computer mediated communication systems.

When MainframePC went from two incompatible email systems to three incompatible email systems after the introduction of Notes, the introduction must at least partly be characterised as a failure. This section discusses whether this failure was inevitable or if more could have been done to reduce the number of Notes boycotters.

Notes was introduced with the groupware aspects in mind, but mainly to improve the possibilities to email communication within the company. How are Grudin's eight challenges described in section 2.4.3 affected if we replace "groupware" with "a new email system, when there already exists a working email system in the organisation"? Is it possible to reduce his list of challenges when users are already familiar with the application, or does it have to be extended because the benefits from the new system do not outscore the existing system enough?

4.7.1 Analysis of the eight challenges at MainframePC

On the basis of the experience of the introduction at MainframePC an analysis follows of Grudin's eight challenges (1994, see also section 2.4.3) applied to MainframePC.

Disparity in work and benefit

The additional work that is required when a new email system should replace an old one is mainly to learn the interface of the new system and to learn additional functionality. If the old system already has a graphical interface, this additional work is limited. However, for the mainframe users at MainframePC there was an interface paradigm

shift, and for the users that were unfamiliar with graphical interfaces the retraining might have been considerable. Also, information stored in the old system must be possible to transfer to the new with as little effort as possible from the users (Bälter 1995).

The benefits of the new Notes system were limited since the mainframe users already had access to email and had developed address lists and routines to handle it. Notes features of smooth handling of attachments was appreciated by many, but a group of mainframe users already knew how to do this on the mainframes.

Critical mass and Prisoner's dilemma problems

Critical mass is an important issue when replacing an old email system, unless it is possible to communicate between the old and the new system seamlessly. If the new system has features that the old system did not have, e.g. handling of attachments, and this makes the new system incompatible with the old, senders should be notified that a receiver will not be able to read these messages. None of this happened at MainframePC and this is still a major problem for the users: to know whether the recipient of an email message actually reads messages in the used system.

Disruption of social processes

The social processes, such as who communicates with whom, would probably have changed already when the old systems were introduced. One of the intentions with the introduction of Notes was to simplify communication within the company by using *one* email system. However, migration to Notes would disrupt communication with the mother company, so the challenge of disruption of social processes was valid at MainframePC.

Exception handling

Formal rules may in practice often be violated. How can such exceptions be handled in the new system? Under the assumption that exceptions can be handled in the same way as in the old system, the challenge of exception handling was not valid at MainframePC. For some users, Notes may solve some of the exceptions in the old system (such as handling attachments).

Unobtrusive accessibility

Hiding rarely used features in the interface, but still have them easily accessible when they are needed is important for the design of the new system, but not for the introduction of it.

Difficulty of evaluation

Although email is a simple CSCW-system, evaluation of the usage is difficult because of the many involved users, the long history of communication, and the often many stored messages. Also, email is rarely the only way for these people to communicate.

Failure of intuition

Failure to realise how a new email system will be used is important for the design of the new system, but less so for the introduction of it.

The adoption process

The adoption process is definitely important when replacing an old email system. Email was in general accepted already at MainframePC, and this may actually make it even more difficult to replace. Bostick, Fritz, Sommers & Hesler (1997) write:

> Email has become so crucial to people's daily work that any change is threatening to a large percentage of people (p 34).

Vandenbosch & Ginzberg (1996a) have studied an introduction of Lotus Notes in a large American insurance company where the users were happy with Notes, but did not increase their collaboration as expected. Their conclusion is that:

> Without careful planning for its introduction and the changes it will entail, the impact of groupware is likely to be limited.

Essler (1998) has studied three different organisations' introduction of Lotus Notes. One of the introductions failed, one succeeded, and one was partly successful. He reports that the successful adoption was characterised by:

- central point of introduction,
- good organisational Notes knowledge,
- a clearly defined role for external Notes consultants,
- moderate and clearly defined ambitions about what the technology was going to accomplish.

Three of these points were characteristic also for the MainframePC introduction. The only exception was the central point of introduction.

Summary

Five of Grudin's challenges seem important for replacing an old email system with a new one at MainframePC, but how should these challenges of disparity in work and benefit, critical mass, disruption of social processes, evaluation, and adoption be handled? In the next section an attempt is made to answer this question.

4.7.2 Success factors for replacing an old email system

On the basis of Grudin's remaining five challenges and research described below describing installations of CMC-systems, I suggest seven factors of major importance for replacing an old email system. Below the identified factors are roughly categorised into things to do before and after the introduction.

Before introduction

- The new system should solve existing problems.
- The management should give a clear support to the system.
- Managers should be given specialised support.
- The new system should include all users.

After introduction

- The system should be promoted continuously.
- An open discussion about the system among the users should be encouraged.
- The users should be educated in several steps.

These factors are described and motivated below.

The new system should solve existing problems

If users are to receive a new system positively, they must have a feeling that the system will help them in their daily work. This can be facilitated by identifying real problems with the existing system and demonstrating how they can be solved with the new system. It is also valuable to define clear goals with the system and explain why alternative solutions have been rejected. The goals can be e.g. saved money for the company, saved time for the company and the employees, or satisfaction by higher quality of the employees' work (Darr 1996; Ploeger 1996b).

Vandenbosch & Ginzberg (1996b) conclude in their study of an insurance company where the expected collaboration that would follow a Notes introduction did not occur that the need to collaborate must exist if a system for collaboration should be of any assistance.

To identify users' real problems with a system, user studies are necessary. Problems that many email users are familiar with are e.g. overview of vast amounts of information of varying importance and missing information caused by the fact that the information is not written or that the location is unknown (Cole & Johnson 1996; Turell 1996). Another known problem regarding email is the existence of several, partly incompatible, email systems that causes problems with attachments, delays, and outside the English speaking community distortion of non-English characters such as üåäö (Järnefors 1995, Bälter 1995).

If a large number of meetings, or inefficient meetings, are considered a problem a groupware system may decrease those problems. According to Darr (1996) and Fujimori (1996) the participants arrive better prepared and follow-ups will be facilitated when protocols are distributed via the groupware system stating who should do what.

The management should give a clear support to the system

It is very important that managers show that they are determined to use the system (Wijn 1996), otherwise hesitancy or resistance may be transferred to other employees. Isherwood (1996) argues that senior staff should participate in all phases of groupware implementation planning due to the major impact a groupware system can have on an organisation by facilitating information retrieval and communication.

Participating in electronic discussions can be unpleasant for many people if they think that a publicly posted message must be faultless or that the ideas must be flawless. Support from management may result in contributions from more employees. For example: managers can set an example by initiating a debate with a message that is not perfectly written in order to enable the employees to contribute with proposals that do not have to be perfect from the beginning (Burke 1996).

Orlikowski (1992) noted that sharing information can be impeded by a promoting

system that “reinforces individual effort and ability, and does not support cooperation or sharing of expertise”. This may cause employees to withhold information to make them indispensable at their workplace. Cooperation should therefore be encouraged, not only in words, but also by promoting people that cooperate or raising their salaries.

Managers should be given specialised support

Person-to-person communication demands between 60 to 80% of the available work hours for a manager (Burns 1954; Stewart 1967; Lawrence 1984). Among the many abilities a manager is expected to have, the skills to communicate, maintain, and develop relations, and also to stimulate employees and other interested parties are considered to be among the most important (Tollgerdt-Andersson 1995). Luthans & Lockwood (1984) describe that 29% of all communication consists of “routine” communication. Email may be suitable to handle at least a part of this. Therefore, it is essential that managers can handle their email system well.

However, as described above by Lantz (1995, 1996) and Whittaker & Sidner (1996) managers have more problems handling their email systems and email flow. At the same time, some managers may have problems asking for help, as this might be seen as a sign of weakness. These problems can be decreased by individual education of managers, preferably by someone within the company. This enables the managers to ask more and also provides them with someone that knows local problems that they can to turn to in the future without loss of prestige (Darr 1996). If some managers do not use the new system, many employees will follow them.

The new system should include all users

Opper (1996) advocates that a plan should be made to introduce the system for the whole company from the beginning, but the implementation should be done step by step. One way is to select a process and construct an application that supports *all* that participate in that process. Another is to develop a complete set of applications for all employees in a department. If only certain people in a process use the system, there will be problems with critical mass and double work (Sproull & Kiesler 1991, Ploeger 1996a, 1996b, Marshak 1996).

Email messages, databases, and documents stored in the old system may have to be transferred to the new system, and the users should be given support for this (Fujimori 1996; Marshak 1996). The same goes for applications that must be run in an old system.

Grudin (1988) noted problems of cost and benefit in a calendar application. If the new system is causing extra work for someone, this person must also benefit from this extra work. Or as Cockburn and Thimbleby (1992) put it: “All additional work must be motivated by personal benefit”. If extra work is put on one person in benefit for another person, the first person will do the work poorly and become negative to the system (Ploeger 1996b, Isherwood 1996, Opper 1996, Marshak 1996). *Mediation*, individuals that intervene deliberately with organisational authorization in the ongoing use of CSCW technology, is described by Okamura, Fujimoto, Orlikowski & Yates (1994) as one way to avoid the cost-benefit problem and achieve critical mass.

Mandatory applications such as time reporting can force users to the groupware

system but if that is the only use an employee has for it, the system is not likely to be appreciated (Hiltz & Johnson 1990; Turell 1996; Harley & Cotter 1996).

Critical mass can be achieved in many different ways, but one factor may be the existence of a "killer application" that makes many people want to use the system. Email itself can be considered as killer application for Web usage according to the results from the HomeNet Project described above (see e.g. Kraut, Lundmark, Kiesler, Mukhopadhyay & Scherlis 1997), but a new email system will not be a killer application for those that already use email. The application does not have to be advanced, a restaurant menu or a phone book that is distributed via the system can be enough (Wijn 1996). If the restaurant menu is made interactive and the phone book is constantly upgraded the users will want to use them and there will be no need to distribute them by any other media than the electronic system. Sproull & Kiesler (1991, p165) give the "King Tut" example when an organisation bought tickets to a very popular museum exhibit to be distributed on a first-come, first-served basis to its employees. Those that did not use the email system came to late too get any tickets. Again, user studies are essential to identify users' real needs.

The system should be promoted continuously

Initially, a new system will always cause problems for the users. There will be things that the users will not know how to do in the new system, that they knew in the old system, or have to do in a more complicated way. One must expect an initial period of decreased productivity and during that time the users will be dissatisfied. It is important to inform the users about this and continue to advocate the long term advantages (Marshak 1996). Research shows that this initial period of performance losses may be up to six months (Bikson, Gutek & Mankin 1987; Stasz, Bikson, Eveland & Mittman 1990).

Orlikowski (1992) noted that if the time that must be spent on learning the new system is "non-billable", the employees become less inclined to use the system. From a user's point of view this is logical, as they optimise their own time. From a management point of view this factor must be taken into account, and the cost for education during work hours assessed against a possible decreased usage of a system.

Ciborra (1996) reported that an introduction that is made smooth and gradual may facilitate a natural diffusion of a groupware application in an organisation. Thereby it will not need internal promotion to expand. This may be true when everything works well, as it did in the installation he described, but promotion will become necessary when things go wrong and negative users argue against the application, although the problems are solved.

An open discussion about the system among the users should be encouraged

After the installation it is important that users have somewhere to turn with questions and complaints; and that these are handled in a serious way to give the users influence on the system (Darr 1996; Wijn 1996). Possibilities to give opinions anonymously can increase feedback from some users (Thomas 1996).

Information should be given to all users in advance to make them aware of both the

advantages and disadvantages of the system (Darr 1996). The personnel responsible for the installation should admit that the system cannot solve all problems (Opper 1996). Successful implementations and applications are easy to write about, but failed projects are particularly important to document to avoid those mistakes in the future (Darr 1996).

The users should be involved in the development of the applications they are to use. Rigid systems planned from above or outside can cause more problems than they solve because of the differences between how the work is planned to be done, and how it is actually done (Grudin 1994; Harper & Carter 1994).

Ciborra (1996) argues that it is up to the organisation to listen to and consider more carefully what happens in order to speed up system development and learning.

The users should be educated in several steps

Users should initially be educated to handle the basic operations of the system and given demonstrations of what it can be used for. Further education should be offered in several steps (Darr 1996; Wijn 1996; Isherwood 1996).

Continuous further education should be planned. Demonstrations of new applications can be given in informal ways, for example in a monthly newsletter, FAQ-database, in the canteen, or at login (Holtham 1996).

Vandenbosch & Ginzberg (1996b) claim that users must understand the technology and that the organisation must provide appropriate support for the introduction and ongoing use.

Every department and project group should have their own expert on the system that can help other users and also suggest development of applications for the group/department. This will facilitate learning and a step by step development of applications and work practices (Hiltz & Turoff 1985; Gantt & Nardi 1992; Trigg & Bødker 1994).

4.7.3 Evaluation of four of the success factors at MainframePC

Since the original study was halted and the post-study of the installation never performed this evaluation is limited to the four suggested “before installation factors”. The results are described below.

The new system should solve existing problems

There were a number of existing problems that the new Notes system could solve that employees were aware of:

- The two mainframe email systems were not fully compatible.
- Files appended to email messages could not be read at the other site. Files that were to be transferred were therefore stored in a common area, and separate messages were sent to notify the receiver to remove the file from that area.
- A department in the company could be located at both sites, so if all employees in that department should meet, some of them must travel two hours to the other site. This may also have affected the possibilities to share information.

- The number of customers with Internet email was growing, but both mainframe systems were incompatible with Internet email. There was a solution implemented for one of the systems, but the other could not handle Internet email at all. Neither of the systems could provide access to the World-Wide-Web.
- The interfaces to the mainframe systems were old, text based, and used inconsistent function keys. A mouse could not be used with either system. Pictures, diagrams and spreadsheets could not be distributed electronically in an easy way.

In summary, there were existing problems that a migration to Notes could solve or at least diminish.

The management should give a clear support to the system

There was an awareness in the company that a change of the communication systems was necessary, the question was not “if”, but “when”. I did meet managers that considered the problems with malfunctioning printers more important, but in general Notes had strong support from the management, from the lowest level up to the global mother company.

Managers should be given specialised support

When asked if there were any special support planned for managers, the response was “No, they will have to manage with the same one-day course as everybody else”, so this could be a cause of the problems at MainframePC.

The new system should include all users

A few departments had already transferred to Notes completely. Individuals that claimed need of Notes were given a license. A plan was made to provide appropriate hardware and servers for the remaining mainframe email users. But, no special efforts had been made to ensure that *all* groups involved also would benefit from the new system. From the pre-study, it emerged that many mainframe developers saw little or no use of Notes or PCs in their work.

4.7.4 Conclusions of the failed introduction

The introduction of Notes at MainframePC was partly a failure. While the Notes users were pleased with the functionality and the interface, especially the smooth handling of attachments, the many users at the company that mastered their old mainframe system had few reasons to switch to Notes. The strength of the infrastructure that the mainframe based global intranet provided MainframePC and the mother company with, turned out to be a major hindrance for the Notes introduction. The growth of Internet and the World-Wide-Web also added to the complexity of electronic communication within the company.

There were several reasons for the failure. The mainframe systems had facilities that Notes could not match. Both mainframe systems were accessible from terminals everywhere, this was especially important to the personnel managers (group and high ranking managers). The design of the functionality for acknowledgement of reception in MMC was superior to Notes’. The PC-LAN used for the Notes communication was

not as reliable as the mainframe network. One of the main reasons that many mainframe users did not adopt the Notes system may simply have been that they mastered their old system and saw no reasons why they should spend time to learn a new system. The mainframe systems were, with a term from activity theory, internalised (Nardi 1996) and the old command based interface was fast and efficient in these experienced users' hands.

The installation failure was foreseeable

The organisations that started to use email early stand today before a change in interface paradigm: a replacement of the old command-based email systems with new systems with a graphical direct-manipulative interface. Grudin (1988) has defined eight challenges for the developers of groupware systems. When these, together with results from other researchers, were applied to the situation at MainframePC, seven factors were identified as important to examine when an old email system should be replaced by a new one. Four of these factors were tested at MainframePC and could at least partly explain why a large group of managers and mainframe programmers did not use Notes.

In summary, from the pre-study most factors pointed towards a successful introduction of Notes. It seemed that Notes would solve most of the problems mentioned above, but difficulties with convincing all managers and mainframe developers to migrate to the new system could be expected.

Results from the pre-study may explain why the Boycotters did not use Notes: the management boycotters may be a result of the lack of special support to managers, and the resistance from mainframe programmers may be a result of the lack of the above mentioned "killer application" for this group, and a somewhat negative attitude towards PCs.

5 Email in a Medical Service Organisation

Both the academic email users described in the study in chapter 3 and the technical users described in the MainframePC study in chapter 4 had at the time of the studies used email for several years, and their usage may not be representative for newcomers to the technology. Also, besides their long experience of email, almost all those users had a technical background. The email usage of the few non-technical[1] users that participated in the study in chapter 3 differed from the others; e.g. the non-technical users had fewer stored messages and no folders.

Another group that used email in a way that separated them from the "average" email user was the managers that used email more than employees. Therefore it would be interesting to study a combination of these groups: non-technical managers.

I searched for a non-technical organisation and found a medical service district, here named Jonrad, that was about to introduce email. At Jonrad medical service district I was allowed to follow five primary care centre managers closely during a year.

5.1 Purpose of the study

The purpose of the study was to seek answers to the following questions:

- How does email affect these non-technical managers' work situation during the first year of email usage?
- How do these managers develop from novices to experienced users when it comes to organisation of email messages?
- Are there aspects of the information flow that make email an important tool to handle it?
- How does email usage affect communication overflow for managers?
- In what way do the non-technical users have a different view on email and computers than the technical users in the previous studies?

5.2 Background

Jonrad medical service district had at the beginning of this study (spring 1997) approximately 100 users of Lotus Notes. The county council, in which Jonrad medical service district is one of three medical service districts, planned to provide access to Notes for all their 5000 employees before the end of the century.

The main interest was the managers of the primary care centres (PCC) as they could be expected to receive a high volume of email in a short time. Within Jonrad medical service district there were approximately 20 primary care centres serving 150 000 people. The district was centred around the city of Jonrad where the large region hospital was located. All primary care centres were located within 70 km (44 miles) from the hospital.

1. Non-technical in the sense that they do not have a technical education, training, or work.

The introduction of Notes was made top-down, starting with the members of the county council managements's medical service group and the top managers of the medical service divisions.

At the beginning of this study the primary care centre managers were the only people that had access to email at the primary care centres. At the end of the study (spring 1998) none or only a few employees at the primary care centres had access to email, besides the managers. A majority of the employees at these centres will get access during this year.

In order to understand the organisation it is also important to understand the strict division between the different professions involved in medical service. In the other two studied organisations, many people have moved between the different professions. In academic organisations people enter as students, graduate and become Ph. D. students, have their dissertation and become teachers or researchers and a few finally professors. The same goes for technical companies: a person may start at e.g. the post office during summer breaks, enter the company after graduation and become promoted to manager at some level.

For both these organisations this results in managers that have previously performed many of the work tasks that their employees are doing today. This is not the situation in Swedish medical service organisations where most employees are trained or educated for one profession such as nurse or physician and then stay in that profession. For example, very few physicians have a background as trained nurses.

This also affects the organisation: e.g. physiotherapists have more in common with other physiotherapists at other primary care centres or hospitals than they have with other employees at the same primary care centre, and meetings are often held separately with each profession group at medical service work sites.

The managers that participated in the Jonrad study may have their own set of problems compared to other managers. The Swedish medical service system has during the last four years been down-sized and re-organised. The ethical conflicts have increased in number due to the advances in medical sciences that make it possible to treat more complaints and reduced budgets that prevent treatment of all patients (Hagenfeldt & Leth 1995).

Most Swedish medical service organisations are politically controlled and this adds to the complexity of being a manager in these organisations. The political values that govern the organisation may change abruptly after an election. There is a detailed set of rules for these organisations, and it is difficult for managers to change structures and processes. On the other hand, these politically controlled medical service organisations are unlikely to be allowed to become bankrupt (Tollgerdt-Andersson 1995) so the economical pressure is not as tough as it may be in commercial companies.

5.3 Subjects and methods

The whole study has been inspired by the methodological implications of activity theory as described by Nardi (1996):

1. A research time frame long enough to understand the users' objectives.
2. Attention to broad patterns of activity.
3. The use of varied data collection techniques.
4. A commitment to understanding things from users' point of view.

Five managers were selected by the person responsible for the introduction of Notes in the organisation. The managers were interviewed in the spring of 1997. One of these managers quit her job during the summer and was not able to participate further in this study. A sixth manager was therefore interviewed the same summer. The first interview dealt with the respondents'

- background and education,
- experience and usage of email, computers in general and specific applications,
- positive and negative experiences of email and computers,
- Internet and Web usage,
- co-operation with other medical and social service organisations,
- planned meetings and how these meetings were affected by their email usage,
- work place communication in general,
- usage of email, fax, paper messages,
- usage of email carbon copies and communication with higher managers,
- handling of email messages (reading, deleting, archiving, retrieving),
- response times, information and communication overflow.

The remaining five managers were interviewed again after one year in the spring of 1998. The second interview contained the same questions as the first with the exception of the background information and addition of comments on the development of the diaries. All interviews were tape-recorded and lasted between one and two hours.

The interviews were made according to the description in Patton (1980) of informal interviews with open ended questions. The interviews were made by following minutes with questions. Follow-up questions were asked in order to make the respondents elaborate certain answers further. When the respondents "jumped ahead" in the interview protocol, they were asked the questions related to their description and then went back to the original order in the protocol. The results from all these interviews are described in section 5.4.

Between these two interviews, the participating managers filled in diaries a certain day approximately every other month. The diaries are a protocol where the participants during one day fill in the number of email messages, phone conversations, meetings, etc. they have been engaged in. An example of a diary is given in appendix C, the results are described in section 5.5.

At the time of the second interview a questionnaire was distributed via the primary care centre managers to the totally 138 employees. In total 111 people responded (80%). The questionnaire contained questions about the respondents' background, computer usage and attitudes, and writing habits (a translated version of the twelve question questionnaire is given in appendix D). The results of the survey are described in section 5.6 and a summary of the findings are described in section 5.7.

To collect background information, informal interviews with the person responsible for the Notes introduction were made several times, and I also accompanied another person in his work as service technician within the organisation. A schematic diagram over the studies is illustrated in figure 5.1.

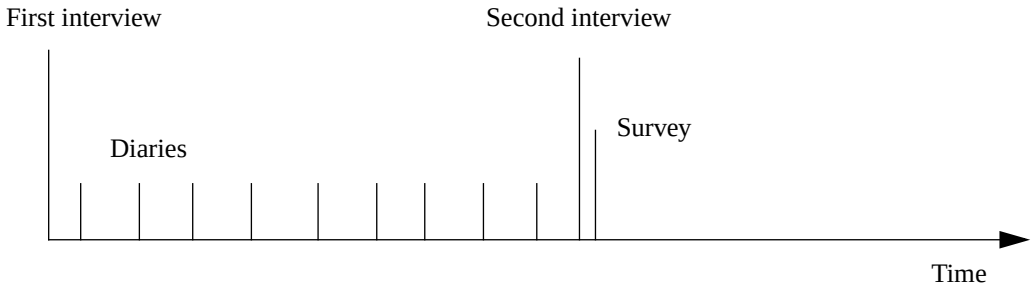


Figure 5.1 Timing of elements in Jonrad study.

5.4 Results from interviews

The results from the interviews are here divided into eight different areas: Subjects' background, Choice of media, Information and communication overflow, Meetings, Handling and organisation of email messages, Computer knowledge and usage, Written communication, and Thoughts about the Web. The distinctions between these areas are not sharp, there are overlaps in some cases. The descriptions of the results are illustrated by quotations from the interviews. These quotations are translated from Swedish and sometimes modifications are added within brackets [] in order to clarify. Italics in these quotations are emphasis made by the respondents.

5.4.1 Subjects' background

Basic data about the respondents are displayed in table 5.1. The managers were between 41 and 51 years, four women and one man. They were responsible for between 14 and 40 employees at their primary care centres. One of the managers was at the time of the first interview responsible for two primary care centres with a total of 100 employees. Only one person was new in the position as a manager, the others had been some kind of manager for between 3 and 20 years. As one of the respondents expressed it:

> I have been a manager here for at least 15 years. They have given the position different names, but the work tasks have been the same.

Two managers were full-time managers, the other three worked between 20 and 50% on other positions, all related to medical service. All had at least three years of university education, mainly as trained nurses, one as a physiotherapist. In addition, they all had at least one semester of education in administration or leadership. Their working hours were normally slightly more than the regulated full time and they had no overtime compensation.

None of the managers had used email before Notes was introduced at their work site. At the time of the first interview, they had between two and six months experience of email usage.

Table 5.1 Basic data of the respondents.

Care centre manager	1	2	3	4	5
Number of employees	13	19	29	33	39
Age	40	40	47	44	50
Manager time	50%	60%	80%	100%	100%
Education	Physio-therapist	Trained nurse	District nurse	District nurse	District nurse
Computer experience	3 years	5 years	3 years	3-5 years	3 years
Email experience	1 months	3 months	9 months	6 months	2 months

Data at the time of the first interview. Manager time refers to the amount of time spent on management. Three of the respondents had other work tasks as well.

There were no direct co-operations with other county councils or medical service districts. Neighbouring primary care centres borrowed staff from each other and synchronised business hours during vacation periods in order to ensure that there would always be at least one primary medicare centre open. Cooperations and discussion groups within some profession groups with participants from several other work sites were common.

During the first interview the respondents were asked to draw a diagram of all the people they communicated with in their work. This diagram provided me with a better understanding of the diversity in their communication. An example what this diagram could look like is illustrated in figure 5.2. There were some minor variations of these diagrams between the respondents regarding the number of professions represented at their centre and their contacts with the university, but figure 5.2 may serve as an illustration for all primary care centre managers in this study.

During the second interview they were asked to revise the drawing if they had altered their communication during the year, but only one respondent made any changes, and then only regarding the direction of the information flow.

In general there were only small differences between the respondents' answers in the first and second interview. The original plan to provide all employees with email access during the time of the study was postponed, and at the time of the second interview there was still no internal communication at the primary care centres. The managers were surprisingly positive to email in the first interview and this attitude did not

change during the year of the study. In the description below, unless otherwise stated, the results describe the view of all managers.

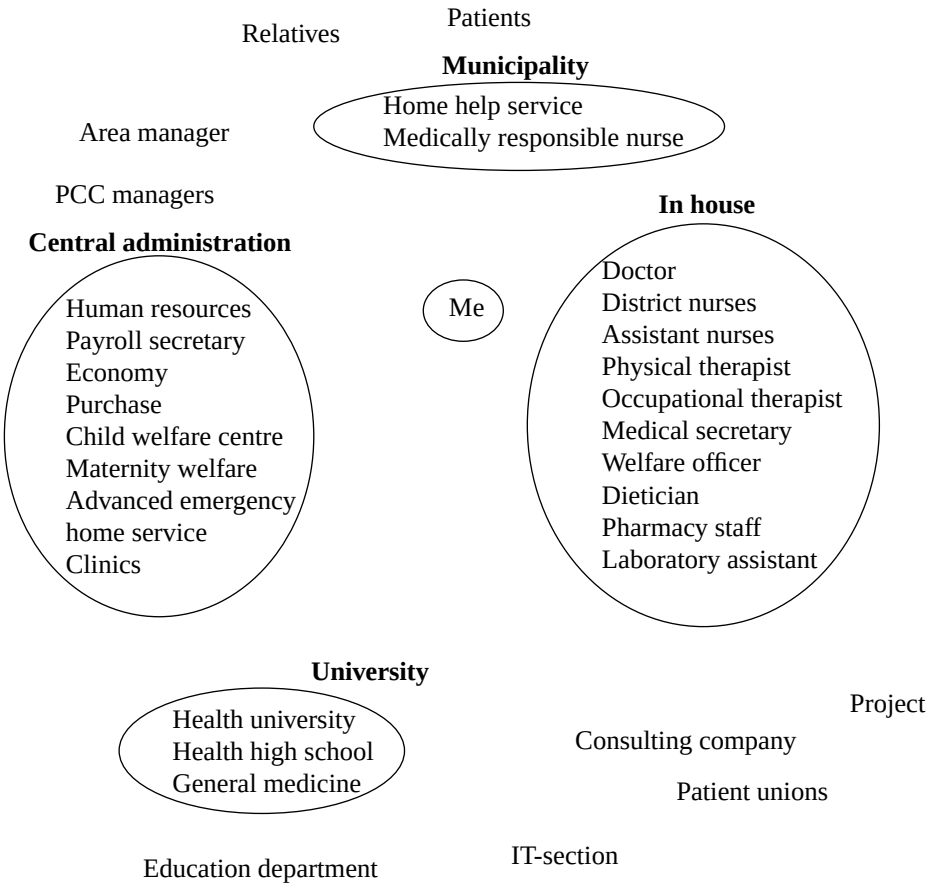


Figure 5.2 Diagram of communication partners at work for the study population.

5.4.2 Choice of media

The possibilities to choose media for communication at these primary care centres for the managers were limited to email, phone, face-to-face meetings, paper mail, fax, and group meetings. The most common situation when a choice between different media could be made was between email and phone, mainly because face-to-face meetings were either accidental or had to be planned as all employees were booked in meetings with patients all day. For the same reason group meetings were planned for several months ahead. Fax machines were used rather seldom at the time of the study. Paper mail was mainly used for non-urgent communication outside the organisation or long or large documents (e.g. budget and economical reports) within the organisation.

The adoption of email was fast among the managers. At the first interview half of the managers claimed that they used fax “only for those that did not have email yet”. All managers were positive to email on their own behalf, but some questioned the planned expansion of users during the first interview:

> I do not think that it is necessary for *everybody* to have access to email. Well, it depends on how far ahead you look, but at least if I look in the foreseeable ten years for example, I do not think so at all. I think that it is more important to invest in those that really would have great benefits from it. Both in better education and teaching them how to use it in a better way. I think we should invest in that instead of volume.

At the time of the second interview, this attitude was more positive.

> I am still a little doubtful whether exactly everyone needs it [email], but I think that the advantages are greater than the disadvantages. The disadvantage to exclude someone is severe, since many will, despite everything, need it.

Email was considered very important for work-related communication. All managers mentioned that they often answered email before other tasks, sometimes to their own surprise.

> Last week I discovered a pile that I had not cared about at all, at the same time as I had nothing in the computer that I had not answered, and it is like this all the time.

The choice of media were according to the respondents dependent on the task, the relation to the receiver(s), and the probability of reaching this person. Email was to prefer for short tasks (simple questions) or when the person was difficult to reach. Phone was the choice for tasks that were sensitive, complicated, or difficult to define:

> I use phone when I feel that I, well it is impossible to describe what I want, so to speak, in paper mail or email, so I must talk to the person.

A close relation to the receiver simplified for some respondents to use email, while others preferred to use the phone for exactly the same reasons. The motives for this varied, and were not always based on a rational time-efficiency choice:

> Sometimes I try the phone first, just in order to chat a little <laughter>, and this is where digressions [from work related tasks] occur. You want to hear how they are today and so on, because email is very short and strict.

All participants claimed that the choice between email and phone was deliberate. Most admitted that they made the "wrong" choice occasionally: they started writing an email message and realised that the task was too complicated to be described in writing, or they called a person and realised that they could have saved time by sending an email message instead. One of the respondents thought that the view of what email is suitable for will change with time:

> I think that I have neglected using email so far. I think that one would dare to use email for a little more "raw" [sensitive] issues.

According to the respondents the main advantages with email were:

- time saving, when you try to reach a person compared to phone,
- the ease of handling short tasks with email,
- security in delivering messages,
- freedom of not having to remember things,
- adequate information.

Time saving

The time savings provided by email may be substantial for these managers. The people they communicated with were often other managers or other people that were extremely busy, such as the person responsible for human resources. Medical service managers that have other work tasks as well were reported to be common in the organisation. With email, the managers did not have to phone these people in different places or find their several different phone numbers. Their descriptions of phone usage matches those described by Bransby (1990) where 75% of all phone calls were not completed on the first attempt.

> I had been searching for half a week [for a person] and left messages everywhere, finally I gave up, I had sort of forgotten email, so I wrote [in an email]: "Call me ASAP". It took about 15 minutes [before he phoned me].

Easy to handle short tasks

Besides getting in touch with people, email also gave the respondents a choice *not* to talk to other people directly as in (Markus 1994a). Many tasks could be handled by passing short messages or questions to other people in email messages:

> It can be an improvement that you can coordinate practical details. There was a manager in the city with a shortage of substitute doctors that could not get anyone. They sent an inquiry [via email] if we knew of anyone, and we sent a message back. And he would not have been able to do that if it had not been for email. In that case he would have had to phone each and everyone, and you do not do that, you ask someone at the office there. Or if you have an answering machine to spare and wonder if anyone needs that, you can send a message and get an answer. These are ridiculous practical details, but I think it can improve coordination in a fruitful way.

Some respondents also described that other people thought more about what they were writing in email messages than other media:

> I think that the messages that arrive via email are better formulated. Short and precise, free from digressions. It is easier to grasp in some way. A lot of other things that arrive here [have] long, long, long harangues before they get to the bottom line. I think that email is more clear, it takes less time to realise what people want.

Security in delivering messages

The managers trusted the email system more than the postal service. This feeling of security may be influenced by the speed of the delivery and the receipt obtained when a receiver opens a message for the first time. The receipt facility was installed as a standard setting for all Notes users in Jonrad medical service district. This had, according to the respondents, resulted in fewer people claiming that they "have not seen certain information". However, these receipts were not always perceived as something positive. One manager mentioned a negative feeling of surveillance due to this.

> It feels annoying sometimes, it is sort of Big Brother is watching you.

Freedom of not having to remember things

All but one of the respondents described enthusiastically how email provided them with possibilities to get rid of work tasks by sending an email to another person and thereby liberating them from remembering these tasks. This freedom of not having to remember things consists of two parts: the automatic storage of what you have written and the most important one, the freedom of not having to remember to return phone calls, mention something next time you meet a person, or remember to send information via email or paper mail. The mail tool automatically form a to-do list.

The things to remember do not only consist of delivering the actual information, but also on finding phone numbers and addresses.

One of the nice features of email for the managers was that the responsibility for remembering things is transferred from the person providing the information or service to the person *asking* for the information or service. When the email message has arrived to the receiver the receiver will automatically be reminded of this when he/she reads his/her email and can handle the issue when there is time (as these managers still did not receive very many messages per day). In contrast, a visible note on the desk will remind the manager constantly, even when the manager is busy with other things. Also, if the manager attempts to remember the task without a written note, the task will "pop-up" occasionally, even when the person is occupied with other tasks. Both the sender and the receiver may also be worried that the issue will be forgotten if it is not written.

This is in line with Grudin's (1988) notion that the person who does the job also must receive the benefits. In this case the person who receives the benefits of the information also becomes responsible for providing a written (email) message. In an organisation where all members heed the practice of answering all messages the sending person can also relax, knowing that the message will be handled.

> [With email] I do not have to remember to call that person that did not answer yesterday. It is a fast way of getting rid of my problem and putting it on someone else's desk.

Adequate information

The primary care centres were overwhelmed with incoming information, see section 5.4.3. This information consisted of a vast amount of paper messages that were of little or no interest for these managers or even their care centres. The messages that arrived via email were, on the other hand, still free from advertisements. None of these managers used email for private communication, and the senders were normally from within the organisation. All this increased the share of email messages that were of interest for these managers.

> It is adequate mail that comes here. In here [in the computer] it is sorted, it is what I need to be able to work. Here [in the paper mail box] comes everything else. All advertisements and such things.

The adequacy of the email messages may also be illustrated by the fact that no email messages were deleted by the respondents without reading the message, but all respondents deleted paper messages, mostly advertisements, without reading them.

The messages that these managers received contained almost exclusively important information.

When the respondents were asked to rank the amount of private communication (defined as non-work related) in phone conversations and email exchange all managers described that there was no or almost no private communication via email, but always some private communication in all phone conversations. This private communication consisted both of the social conventions that makes us say “Hello, how are you?”, “Fine and you?” and the fact that when they were speaking with a person they knew regarding a work related issue, they felt both an urge to ask about private matters and that it would be impolite to not ask about private matters first and then handle the issue that was the reason for the phone call.

> There are some short introduction phrases in most conversations. A plain exchange of courtesies.

The lack of these social conventions in email (see e.g. Sproull & Kiesler 1991, pp 54) and urge to communicate about private matters first make email even more important in situations of time pressure.

Phone advantages

The managers expressed the view that email cannot replace meetings or phone conversations completely. They stated at least three reasons for this:

- It is important to listen to reactions and feelings that are difficult or impossible to express in an email message.
- Speaking to people is one way of maintaining or developing a network.
- It is fun to talk to people.

Although messages where someone asks the manager to phone back felt more urgent for the managers, the acknowledgements of reception in Notes added to the pressure to answer email messages before other messages. The feeling that it was easier to answer email messages and the feeling that they were temporarily rid of the task also added to the wish to answer email messages before other messages.

5.4.3 Information and communication overflow

Information overflow, as described in section 2.5.3, was well-known by all managers, and they expressed their feelings about it with strong emphasis and expressions such as “incredibly much”, “thick volumes”, and “drowns in information”. When they described how much paper mail they received each day they measured one to three decimetres (up to a foot) between one of their hands and the desk. The bulk of this paper mail was advertisements for courses, drugs, and medical equipment.

> It is not so much that you have to search for information, it is more that you have to sort out the [important] information [in the enormous amounts] you get.

During the year, the information flow had in general not changed according to the managers. Certain parts had transferred from paper to email. This had both advantages

and disadvantages. The advantage was the simplicity of handling email compared to paper-based information. One disadvantage was that certain types of information should always be printed e.g. it was necessary to bring the information to meetings at the primary care centre to inform the other employees, and put in a binder after the meeting. When that sort of information arrived via email, the managers must spend extra time to print these messages and remember to go to the printer 10 to 30 meters from their room.

The same message may also arrive from several sources: from managers several steps up and also from employees that had received a paper version of the same message.

> We may have received the message via Notes and then we get it once more from the area manager who writes that "I do not know if you have received this, but just in case..."

> They do not always select who they are sending to, *everybody* gets this without having any use for it an any way. I suspect that if you send paper mail, you are more careful when you send it [who you should send it to].

This phenomenon of deliberately sending messages to recipients that have no need for the information is discussed in Sproull & Kiesler (1991). They also provide estimates of the time wasted in an organisation to handle these messages, and compare that to the return value for the company.

Some managers speculated about the future flow of information.

> What I have thought about is forwarded messages. Sometimes you receive messages that have been forwarded, I do not know how many times, and that makes you wonder, the more people get email, how will that be in the end?

> Now they [the email messages] come only one way, from above. But when everybody gets it [email] they [the messages] will come from everywhere.

There was a learning period to handle certain information for those that were new on their position or due to the recent changes in the organisation:

> I do not know what to expect, so some things *fall* on me [suddenly appear] that I do not have any knowledge of. It will become easier eventually when you know that now will these papers arrive and you can expect them to arrive instead of being surprised by them.

Communication overflow

Communication overflow, as described by Ljungberg (1996) and referred to in section 2.5.5, was not known as an expression by the managers, but when explained as "more people want to discuss issues with you than you have time for by any type of medium", all stated that they had experienced communication overflow, but of varying frequency.

The main causes of communication overflow was questionnaires that should be answered frequently and too many meetings.

> It is difficult to know which meetings you have to go to, is this really necessary?

> To know what is un-necessary is impossible until you have been to the meeting.

They all also reported that their employees came into their offices or stopped them in the hallways to discuss, but none considered this as a communication overflow, although these unplanned meetings occurred frequently. When asked why, they answered that they felt that this was what their job was really about – being there for their employees.

> I have actually encouraged people to come to me and say what they have to say directly to me rather than [receiving the information] some other way. Maybe I should control it better, not interrupt myself all the time.

For managers that were interrupted often it was important to be able to handle interruptions and quickly get back to the previous task.

> If I sit and work with the computer and am writing something, or am about to communicate [via the computer], and some other person comes here and wants to talk with me, it is so much easier to interrupt it [the writing], but a phone conversation is more difficult [to interrupt] if someone enters my room.

Only one manager had actively done something about the communication overflow, and that was avoiding some of the meetings she was summoned to. However, several of the managers worked overtime "to avoid interruptions from the employees". All managers sometimes went back to work in the evening, or early in the morning to avoid their employees. One of the mangers used the expression "sneaked back" to describe his actions.

5.4.4 Meetings

The planned meetings that these managers participated in can be divided into information distribution and discussions. Information distribution was usually directed to their employees, and several of the managers wished that these meetings could be more of discussions. Especially the meetings with the whole staff were lacking discussions. The meetings they had with smaller groups of employees, often a single profession, were much better. The discussion meetings were usually with other primary care centre managers and their area manager.

The only meetings that could be affected by the usage of a CMC-system (Computer Mediated Communication) at the time of the study were the meetings between the primary care centre managers and their manager, since this was the only group where all involved had access to email. Several of the managers mentioned that there was room for improvements of these meetings. Especially there was a wish to limit the time used for each issue, clearly decide what to do about each issue, and handle the postponed issues on next meeting.

According to Darr (1996) and Fujimori (1996) meetings may be affected by a CMC-system: the participants arrive better prepared and follow-ups will be facilitated when minutes are distributed via the groupware system stating who should do what. No such effects had been noted by these managers, with the exception that summons and minutes were handled via email. This possibility was, however, considered important as the managers could inform other participants of the meeting that they were arriving late or postpone meetings with a short notice.

One advantage that the managers mentioned during the second interview was that

all participants were aware that they all had the same information.

> You cannot claim that "I have not received that paper".

Another difference between the first and second interview was that during the first interview, some of the managers mentioned that certain information was handled via email between the meetings with the area manager and the other primary care centre managers, instead of being handled at these meetings, but no-one mentioned that during the second interview. One manager expressed the lack of change in these meetings:

> We have the tool [Notes], but we do not use it [to improve our meetings].

The reasons for not mentioning this information handling between the meetings may be that they had internalised this behaviour.

Unplanned meetings

Although often short in time, the unplanned meetings take a fair share of these managers' work day due to the large number of such meetings.

> You can rarely sit even one hour and work in peace and quiet. Rarely.

> They [unplanned meetings] are very common. Way too many. It is one of the difficulties with this job actually, that you are constantly interrupted. There is always someone coming in, so to speak. There are always big and small questions. [It is] difficult to limit these because it seems as people also must have the opportunity as well. This is the reason why you have to stay here, when everybody has gone home, because then you get the peace and quiet to do things. That is the time where everything goes fast. There are certain things that I do not even start with [during the day] because it is impossible to focus. You just waste your time if you think that you could do certain things, because you will be interrupted constantly. But on the other hand, I am not very good at saying that I am busy. It is hard to do. They only want to come and tell me that something is wrong, or that they do not feel well, or that they feel good.

These interruptions caused by the unplanned meetings may have been a problem only for the managers, their employees were booked in meetings with patients all day. When employees got a pause in these meetings, they could go to the manager, but the manager could rarely interrupt the employees' meetings with their patients.

> We can never have spontaneous meetings. We rarely have that since we have patients all the time. We must plan ahead if we should have a meeting. It is impossible to say "let us meet in fifteen minutes". No-one will be able to.

The unplanned meetings often raised demands on the manager to be able to drop everything and act immediately.

> The planned [meetings] have a structure in some way. The unplanned ones may occur anywhere and they are often about internal, emergency things, well problems, conflicts, it can be anything. It is the preparations, if we pick conflicts as an example, I cannot prepare myself mentally, prepare what to do if this or that happens. If it is unplanned you can never prepare for it, so it is a spontaneous meeting.

These interruptions might however be better than placing people on a to-do list.

> I think that the communication overflow is also partly self created. It is not only others that want to speak to me, but also that I want to speak to others. And it might be better that you support them so that you do not feel that, oops I must speak to him and her and settle that and that. In that case you might be more stressed. I am unaware of those who want to come and talk with me until they come here and then I usually take care of it.

5.4.5 Handling and organisation of email messages

Email had become a very important tool for all participants. They all read email several times a day. All answered email messages as soon as possible. Turning on the computer was the first thing they did in the mornings, sometimes before they took of their coat. When messages arrived during the day and they were in the room and heard the audio signal they opened the incoming message. All but one allowed incoming email messages to interrupt other tasks. All considered email messages more straightforward than paper messages.

Interruptions by incoming messages

The only person that claimed that she did not allow incoming messages to interrupt other tasks gave two reasons for this: 1) it took a long time to switch between the different applications on her computer; and 2) email messages were rarely urgent.

All others dropped their current task and rushed to their email when they heard the signal of a new incoming message. They also admitted that this behaviour was stupid.

Respondent A:

> Q: What happens when you hear the signal of an incoming message? Do you interrupt other on-going tasks?
>
> A: Yes, I often want to do that. I'm so curious that I <laughter>. I actually do that. But if an ordinary paper mail arrives I do not. It is quite strange.
>
> Q: Don't you feel that this is stupid sometimes?
>
> A: Of course it is. Certainly.

Respondent B:

> Q: What happens when you hear the signal of an incoming message?
>
> B: Then I have severe problems not looking to see what it is.
>
> Q: Regardless of what you are doing?
>
> B: No, not regardless, but it is *very* difficult to not... In some way it is exciting, it is almost as telephone, it is also, it also may interrupt everything.
>
> Q: Do you think that it is wise to do this?
>
> B: No, I do not think so.

This behaviour would be natural for new email users that have not received very many email messages and therefore each new message would be a novelty, but at the time of the second interview, these managers had received more than a thousand messages. For these managers that had become experienced email users there must be other explanations:

- They had transferred behaviour from telephone usage where incoming calls may interrupt on-going tasks to a great extent,
- they were expecting important messages from someone,
- plain curiosity.

Other descriptions of how users allow email to interrupt other tasks can be found in Mackay (1988), Severinson Eklundh & Macdonald (1994), and Lantz (1996).

Organisation of email messages

When it comes to organisation of email messages only one person started using folders during the first year. All the others claimed that they had a need to structure their messages, but did not know how to do this. Some of the respondents even claimed that folder usage had not been a part of their Notes course.

In the standard installation there was a Notes view designed especially for Jonrad medical service district that included a button that moved selected messages from the inbox to a folder named "MyOwnFolder". This facilitated the usage of *one* folder, but at the same time prevented users to use more folders. Those that succeeded in creating new folders did not automatically get a corresponding button to move messages to these new folders and therefore did not know how to move messages into the new folders. One user finally gave up her attempts to organise messages within Notes and moved her email messages to the ordinary file structure and organised them there.

The only person that started using folders created new folders at the same time as cleaning sessions occurred. He claimed that the reason for using folders was problems with overview:

> In the beginning I did no sorting at all, and then it is not difficult to sort. Instead it was very difficult to get an overview. So if you had asked that question you might have got the maximum point on that question [on a four grade scale with one as no problems and four as severe problems]. But when I started using folders, then I suddenly had to think about how I should sort, and that becomes somewhat difficult.

The subject line is important for sorting and overview. Modern graphical email systems often have write protected the subject line of incoming messages, which prevents the receiver to give the message a proper subject according to the receiver's view of the message's contents. One of the respondents complained about this and also that the editing possibilities of incoming messages were limited.

> The subject line may say that it is subject A and when you open it you can see that it is two or three documents that are subject A, B, and C. I actually would like to have B in another folder than A. I would like to, [but] when you store in folders you can only see the subject line.

The respondents reported that their email messages in general were deleted at one of three different occasions: directly after reading it the first time, during browsing and searching for other messages when they notice that a message is a thing of the past, and finally during cleaning sessions. Cleaning sessions occurred irregularly between weekly and monthly and were prompted by a combination of "spare time" and overfull mail folders. Overfull in this case seemed to be somewhere between one and two

screen pages full.

This handling of the deletion of messages is a good description of the folderless cleaners and, for the only person that started using folders between the interviews, frequent filers described in section 4.4.7 in the MainframePC study. All five respondents in this study were initially folderless cleaners.

5.4.6 Computer knowledge and usage

Although computer knowledge was not planned to be a part of the study, it was striking during the first interview series that both these managers and many of their employees considered computer knowledge and training as one of the most important issues. During coffee breaks several employees described that they were worried about the introduction of more and more computer technology in their work place. Their deepest concerns were that they felt that they had inadequate or no computer training and feared that they would be replaced with younger personnel that came directly from school with the same medical training, but with computer knowledge.

All managers had used computers at least two years at the beginning of this study. The most common applications was the computerised case record and the calendar program, but lately word processors and spreadsheets had become standard work tools. The managers worked with the computer between half an hour and three hours a day, but it varied a lot from day to day.

All participants stated that they did not know enough about computers to handle their jobs properly.

> I think that many of the problems we have regarding computerization are handling problems, that we do not really understand how a computer works.

This lack of knowledge concerns both general computer knowledge and knowledge of applications such as spreadsheets and word processing. In some cases they knew how to do things, but it took time to do it:

> Then we have this matter of attachments of Word-files and such. I can do it, but it takes so much time that I hesitate to do it.

This problem will remain as long as there are alternatives:

> If we removed the fax machine so that I could not fax, then I would be forced to [learn how to handle attachments properly].

A more difficult problem was the lack of general computer knowledge. It is difficult for a manager to compare different computer systems in order to participate in decisions of purchases without knowledge about the effect and demands of e.g. clock speed, RAM and server size and speed.

> You trust the judgements that are made, and all too often they are incorrect and I don't know why, but that is the way it is. And you do not have enough knowledge to realise that [the judgements are wrong]. You suspect it, because you get so many different answers. There are very many technicians that come here. They are uncountable and as a rule you get very many different answers to the same question and then you suspect that that nobody really knows. In a way it would be better if they said so [that they did not know].

> We do not have this technical knowledge, and I expect that it [the technical knowledge] should exist somewhere else.

This lack of knowledge applies also to the usage of email. All managers stated that they knew that they would be more efficient in their work, if they took time to learn more about Notes, but still they could not find that time.

> It is about me, it is not the system.

For a person that lacks computer knowledge it is also difficult to know what to do about a problem and define whether it can be solved or not.

> One problem that I have heard that others have had, I have had it once, was that the document was unreadable when I got it. It was explained in some way that there were different Word programs. The person who writes has for example 7.0 and I have 6.0 or something like that, then it can be difficult to read.

> The economical report was unreadable by [e-]mail, so I printed it and got 25 pages, still unreadable. And then you have someone in [village name] that is smarter than I am who said that you should enter Excel and then you can get a nice diagram. But I cannot do that!

These feelings of uncertainty and need for help may of course be a hindrance for introducing more or new technology at these centres. The problems described here are similar to those described in the HomeNet Project where the participants' initial computer knowledge affected their use of the net still after one year (Kiesler, Kraut, Lundmark, Scherlis & Mukhopadhyay 1997). Another problem in the HomeNet project was that those that did not call the help desk dropped out from the experiment. It is not far fetched to assume that those who call for help and do not get it also will stop using the technology. One problem is to bridge the the gulf between the medical service and the technical staff.

> People come from the IT-division and different computer companies and try to explain for us. And it is like we do not understand everything they say. They should provide us with service and programs and we should work with them and they do not understand what we are saying and we do not understand them.

One of the managers was dispirited about the future for IT in medical service:

> In a few generations there will come a generation that has learnt this [IT] in another way. They will have it in their blood, and things should become better then. This resistance that exists among many in my age [to learn more about computers], might not exist then.

Her employees were in general 40-45 years, which means that this change of generations will take at least 25 more years.

During the second interview I discussed informally with several of the respondents about problems learning how to use computer programs. The difference between the person that had started using folders and the others seems to be a different mental model of the computer. While the folder user found the menu commands for creating folders by exploring the menus and merely adding a function to the others in Notes, the others thought about the same function as a sequence of actions: for example com-

puter, programs, Notes, location in menu bar, location in menu.

The difference between these models is that in the first, adding functionality becomes adding understanding to one of the existing menu choices. In the second model several steps (five to seven in these interviews) have to be memorised.

5.4.7 Written communication

All participants claimed that email differs from paper communication, and email messages were more undemanding to write than paper mail. The reasons for this were that email messages were less formal and that the tasks you handle in email messages were less complicated.

> You don't have to think so much about how you write when you are writing an email, you write more like you speak.

However, writing is a skill that does not come naturally for all. Only one respondent claimed that he had no problems with writing. All others mentioned that they had problems formulating themselves in writing.

> And this with knowledge of writing, I am not used to that. I usually describe orally what I want to say and then my secretary writes it down and I sign and send it. It´s a different way of working.

This is another skill that email requires of the users besides handling the computer and the email program: the ability to communicate in writing.

Information was, according to these managers, in general easier to search and find on the computer and short pieces of information were perceived as easier to handle on the computer. However, all preferred to read longer documents on paper.

One person had started to use the databases for medical service programs and the regulations for the medical service organisation. This person preferred to read the regulations on paper because she thought that it was more easy to find things on paper because of the index and the list of contents. After reporting this, she corrected herself, realising that the same index and list of contents would exist in the database version as well.

None of the respondents participated in electronic discussion groups, but one of the respondents participated in a real life discussion group about asthma.

5.4.8 Thoughts about the Web

The Web was not used at the primary care centres, but was considered as something useful both for the employees that could search for information on the Web and for the patients that could search for the same information.

There were Web browsers installed on the computers, but the medical service organisation had not yet decided who should get access to the Web. Therefore, some managers used the Web from their private home computer to find job-related information, printed it and brought it to work.

Today there are patients coming to the primary care centres with printouts from the Web of treatments that they would like to have. This causes problems for the employees:

> Within child care you can see that these young parents, I mean for them it is perfectly natural to surf the Internet for information. So we should have access to it so that you could keep yourself updated about what is said and written, you know there are some preposterous things there too. But you should have the possibility to keep yourself informed.

5.5 Results from diaries

In order to follow the development of the managers' handling and organisation of the email messages they filled in a diary protocol (see appendix C) one day approximately every other month during the year between the two interviews. The diary protocol consisted of two columns, one that listed different types of media, and one where they should mark every time that communicated with each media. The media in the list were email, telephone, fax, paper mail, unplanned meetings, planned meetings, and searches in databases.

The respondents were asked if they had had any problems with filling in the diaries during the second interview, but besides the question about unplanned meetings and the problem to remember to fill in the diary at all, no-one thought so.

The problem with unplanned meetings was the definition. My definition was "any meeting face-to-face where a summon has not been distributed in advance", but I failed to explain this to three of the respondents. Of the remaining two, the manager working at the largest primary care centre counted these meetings one day and came to the sum of 35 and then gave up due to the large number of unplanned meetings that occurred outside her office. During the second interview we came to the conclusion that she would have been helped by a counter that she could click on for every meeting. The number of unplanned meetings are in line with the findings of O'Conaill and Frohlich (1995). The remaining person worked in the smallest primary care centre and had between 9 and 17 unplanned meetings a day, with an average of 12.

The other diary variables are displayed in table 5.2 together with the number of employees at each centre.

Table 5.2 Summary of diaries from the managers. Average per day.

Care centre	1	2	3	4	5
Number of diary protocols	9	10	4	6	7
Employees	13	19	29	33	39
Received email messages	8	4	4	4	13
Sent email messages	3	4	2	1	8
Sum of # of recipients of sent email	3	5	2	-	11
Deleted email messages	16	4	4	4	15
Received paper mail	10	7	5	7	9
Sent paper mail	3	4	5	4	2
Received fax	1	1	2	0	3
Sent fax	0	0	2	0	2
Phone calls (in and out)	7	11	7	10	28
Planned meetings	1	1	1	2	3
Problems handling Notes	No	Small	No	No	Small
Problems handling email flow	Small	No	No	No	Small
Problems sorting email	Small	No	No	No	Small
Time pressure	Large	Small	Small	Small	Large
# of stored email messages	73	48	46	36	220

Numbers are mean values. Categories are medians.

The data from the diaries was the base for some interesting discussions during the second interview described in the previous section. The following observations from the diaries are not described previously.

Many of the variables in table 5.2 vary greatly between days. According to the respondents some days becomes “phone days”. One phone call lead to another and it becomes difficult to switch to another medium. One of the managers had 72 phone calls in one day due to a staff issue.

One of the questions on the diary protocols regarded sorting of email messages. The respondents were asked to state whether they had *No, A little, A lot,* or *Severe* problems with sorting. The only person that started to use folders for email messages had the following development, illustrated in table 5.3. In the beginning of the year he had no problems with sorting at all, but with time the sorting problems increased to “Large”. Apparently these sorting problems became so large that this person started to use folders, because in the next diary the problems has dropped to “No” and the number of folders has increased to four. At the same time the number of stored messages drops from 60 to 36. These four folders were apparently not the solution to all sorting problems, because in the next protocol the problem level has increased to “Small” and

remains at this level until the number of folders was increased to twelve and some additional time has elapsed. Once again at the creation of the additional eight folders, the number of stored messages dropped, this time from 95 to 57. According to the protocol the person actually deleted 61 messages this day, which may explain why the sorting problems still were “Small” instead of “No” – the new folders were not in effect until the end of this cleaning session.

The other respondents showed either an increasing number of messages and reported sorting problems, or a more or less constant number of messages and no sorting problems. None of these used folders.

Table 5.3 One respondent’s diaries of folders, stored messages, and sorting problems.

Week	1	7	12	27	30	33	37	41	50
Sorting problems	No	Large	No	Small	Small	Small	No	No	No
# of folders	1	1	4	4	4	12	12	12	13
# of stored messages	-	60	36	76	95	57	56	88	115

The problem with handling the flow of email was in this study not related to the actual number of email messages, which confirms the findings in e.g. Hiltz and Turoff 1985, Mackay 1988, Bälter 1995, and Lantz 1996. There may be several reasons for this. When the four respondents that reported problems with handling the flow were asked about this during the second interview they described that this problem was not related to the actual number of email messages, but their contents. Ten messages with short information can be handled in shorter time than one message with a complex question. Also the time to handle these messages were affected and interrupted by phone calls and planned and unplanned meetings with employees. Planned meetings were normally less than three a day for these managers, but could be as many as six.

The problems reported in handling Notes were mainly failures with the connection to the main server, or other hardware related problems. The reported problems with the interface regards problems of handling attachments and the previously described (page 139) problems with moving messages to folders.

5.6 Results from the survey

The results from the interviews in section 5.4.6 and 5.4.7 that described lack of computer knowledge among both managers and employees, worries about computer technology about the employees, and difficulties with written communication could be a major hindrance for the introduction of Notes to the employees at these primary care centres. It therefore became important to investigate the usage of computers today, writing habits, and attitudes towards computers among the employees.

When the managers were asked if it was possible to distribute a questionnaire to their employees they all agreed, but also warned that the employees might not answer it, implying that they were tired of questionnaires. In order to maximise the response rate the questionnaire was therefore limited to one page, avoiding all open ended ques-

tion but one. Almost all questions had the same answer alternatives:

Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.

The questions concerned background information (age and profession), writing habits, computer usage, and general computer attitudes. A translated version of the questionnaire is given in appendix D.

The questions about writing habits and computer attitudes may seem loosely related to the research issues, but the interviews described in the previous section indicated that these factors might be important when these non-technical employees will get access to email.

Subjects

The questionnaire was distributed via the primary care centre managers after the second interview to the totally 138 employees at these centres. In total 111 people responded (80%). The primary care centre managers are not included in this study. The age of the respondents varied from 29 to 62 years with a mean and a median of 46 years. A majority (68%) of the employees were between 40 and 55 years old. No respondent was younger than 29 years or older than 62 years.

The distribution of professions among the employees is displayed in table 5.4. The most common profession among the respondents was district nurse followed by secretary, physiotherapist and assistant nurse.

Table 5.4 Professions among the employees at the primary care centres.

Profession	# of respondents
Assistant nurse	13
District nurse	36
Doctor	10
Laboratory assistant	4
Occupational therapist	8
Physiotherapist	12
Physiotherapist assistant	2
Midwife	7
Secretary	15
Trained nurse	2
Other	1
TOTAL	110

As expected, the predominance of women was great: 93% of the respondents were women. The eight men were doctors (3), physiotherapists (3), one district nurse, and one “other”.

The employees had a long experience of medical service professions. The average and median time in medical service was 22 years and 93% had more than 10 years in medical service.

Computer usage

The usage of computers among the employees was expected to vary a great deal, and this may affect the future usage of email. Therefore five questions were asked about computer usage:

> How often do you use the computerized case record at your workplace?
>
> How often do you use the computerized calendar at your workplace?
>
> How often do you use computer programs in general (including at home, e.g. word processing, spreadsheets, games)?
>
> How often do you use electronic mail (at work or home)?
>
> How often do you use computers at home?

The answers are displayed in table 5.5. The computerized case record was used by almost everyone daily, while the calendar was used slightly less. Almost half of the employees used computers for other things daily, but only 22% used email at all. Since only the managers used email at work, this means that more people had access to email at home than at work. Almost 70% of the respondents claimed that they used a computer at home at least once a year, which was a surprisingly high percentage for access to a home computer. Expected average would be between 25 and 34% according to Teldok (1997) when gender, education, geographical location are accounted for; but those figures are from 1995 and the amount of personal computers at home are still increasing fast in Sweden. An average for the whole Swedish population from 1997 is 42% (Petrov 1998).

When the variables for age and computer program usage in general were combined there was as expected a tendency among younger people to use computers more often. Those that use a computer daily were in average 43 years old compared to 47 years for those that used computers more seldom. A t-test gives a P-value of 0.07.

Table 5.5 Computer usage frequency of the employees at the primary care centres.

Usage of	Never/Do not have access	Once a year	Once a month	Once a week	Once a day	Several times a day
Case record (n=111)	2 %	1 %	0 %	2 %	4 %	71 %
Calendar (n=111)	7 %	0 %	2 %	7 %	7 %	58 %
Programs in general (n=109)	7 %	9 %	12 %	16 %	11 %	24 %
Email (n=110)	21/41 %	4 %	5 %	6 %	1 %	2 %
At home (n=111)	3/22 %	8 %	11 %	28 %	7 %	1 %

The two last questions in this table had an extra alternative “Do not have access to”, hence the two values in the second column.

Attitudes towards computers

During informal discussions at e.g. coffee breaks, many employees stated that they both embraced and feared the new computer technology. Therefore two questions were asked about their attitudes towards computers. The first question was:

> According to your opinion, do you regard your knowledge of computers as adequate for your work tasks?

With the answer alternatives:

> Comply completely❑, partly❑, not at all❑.

The second question was open ended:

> Please describe your attitude towards computers in general:

Only five respondents (5%) agreed completely to the statement that they had adequate knowledge of computers for their work tasks. Almost two thirds or 66% agreed only partly and 30% did not agree at all to the statement. No significant difference could be detected between these groups regarding age.

The open ended question gave an opportunity to the respondents to express their views of all aspects of their relations towards computers. A large number (91) of the respondents, or 82%, wrote at least something on this question. The answers can be categorised into negative, neutral or mixed, and positive attitude. A majority (51%) of those that answered wrote only positive things about computers, mostly short comments such as “Good” or “Fine”. Those that were positive used on average 12 words compared to 34 for the negative respondents (a t-test gives a P-value of 0.0007).

> Very good means of assistance both at home and at work, but education at work is far from enough – a pity for all those that do not have a computer at home. You have to ask colleagues. Particularly difficult as a temporary.

> A fantastic mean of assistance – opens enormous possibilities both at work and at home. Knowledge is missing – in large quantities.

The other large group was the 43% that were neutral or wrote about both positive and negative things with computers.

> Very good work tool when it works. Unfortunately vulnerable for e.g. power breakdowns, disturbances etc. Difficult to work when the whole system is built upon computers that should work.

> Good. Easy to change <u>but</u> you become careless compared to typing on a typewriter. Need more paper now than with a typewriter. Long term storage? [I] know that paper can be stored for 100-200 years, but computer? Straining for the eyes. Buzzes – hard for the head. Radiation – skin problems in the face. Smells something diffuse.

Only 6 respondents had only negative things to say about computers.

> [I] am sceptical. Computers are allowed to cost money while staff is down-sized. A computer does not treat a patient that needs help for e.g. pain.

The descriptions of lack of computer knowledge and demands for more education about computers in the quotations above were common. A total of 27% complained

about this. The need for further education has also been described by e.g. Darr (1996), Wijn (1996), and Isherwood (1996). Those that wanted more education had a tendency to write more words (on average 23) in their answers to the open ended question than those who did not mentioned it (on average 16, a t-test gives a P-value of 0.07).

The worries about negative attitudes towards computers described in the interviews could not be confirmed by the survey. An explanation for this may be that those that were negative or worried were more expressive as they used more word to describe their opinions. Those that were only negative used on average 34 words in their answers to the open-ended question compared to 12 for the positive respondents (t-test P-value 0.001).

It was impossible to make any statistical significant observations about gender differences due to the small number of men at these work sites.

Writing habits

Since the interviewed managers mentioned difficulties with formulating themselves in writing, it would be interesting to know the writing habits of the employees. Therefore they were asked:

> How often do you write letters or reports (at work, home, by hand, machine, or computer)?

Hardly half of the employees wrote letter or reports at least once a week, but a majority of these wrote daily. The distribution is displayed in table 5.6.

Table 5.6 Writing frequency of letters and reports among the employees of the primary care centres.

Writing frequency	# of respondents
Never	2
A few times a year	22
A few times a month	21
A few times a week	22
A few times a day	14
Several times a day	27

This was the only question about writing habits. There was a relation between the answer to this question and the length of the answer to the only open ended question about attitudes towards computers. The more often a person writes, the longer were their answers to the open ended question, as illustrated in figure 5.3. Those that wrote at least weekly used on average 17 words in the open ended question compared to 11 for those that wrote more seldom (t-test P-value 0.03). This suggests that those that use computers seldom might have difficulties expressing themselves in writing. It is, however, impossible from this study to draw any conclusion on what is the cause and the consequence of the positive relation between computer usage and writing abilities.

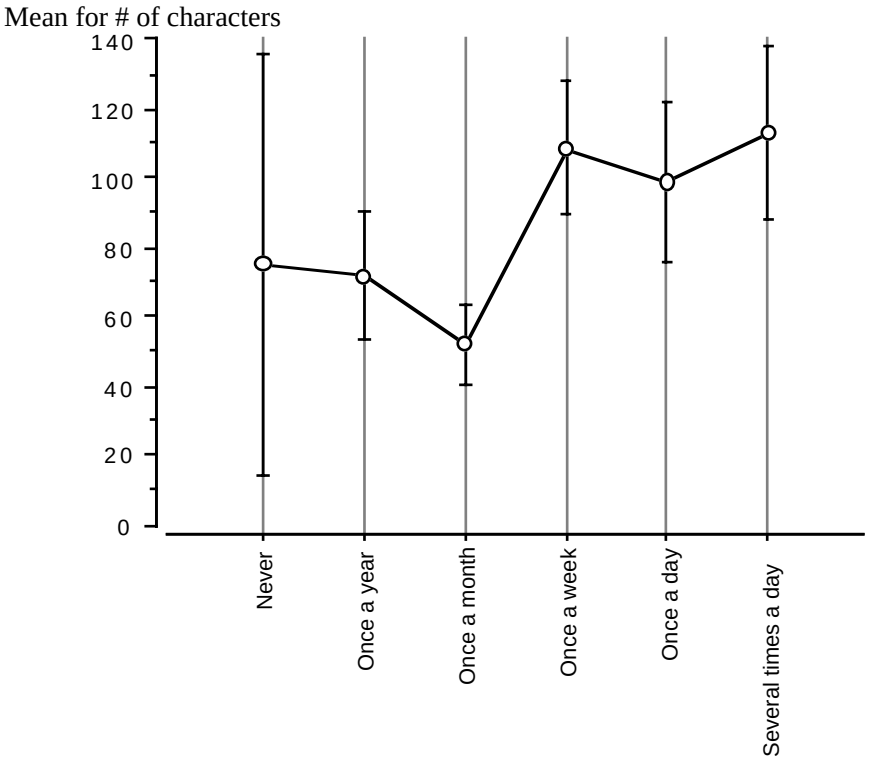


Figure 5.3 Relation between writing frequency and # of characters in last question.

Younger people wrote more often than older people. Those that wrote at least weekly were on average three years younger (44 compared to 47) than those who wrote more seldom (a t-test gives a P-value of 0.046).

Those that used the computerized calendar several times a day had a tendency to write fewer words in their answers to the open ended question compared to those that used the calendar less often. A t-test gives a P-value of 0.09. If the respondents that had a negative attitude towards computers are excluded the P-value drops to 0.056. An explanation may be that the calendar program restricted writing space by small windows, see figure 5.4.

Table 5.7 Number of words in the open ended question in relation to computer usage and usage of the calendar program.

	General computer program usage	
Calendar program usage	Daily	More seldom
Several times a day	15 words	12 words
More seldom	21 words	16 words

As displayed in table 5.7, there was a tendency for those that used the computerized calendar several times a day, but computer programs in general more seldom than daily, to write shorter answers (on average 12 words) compared to those that use the calendar more seldom and computers more often (on average 21 words), a t-test gives a P-value of 0.07. If the respondents that had a negative attitude towards computers are

excluded the P-value drops to 0.04.

Computer usage in general seems to be associated with longer answers to the last question, while usage of the calendar program seems to be associated with shorter answers to the last question.

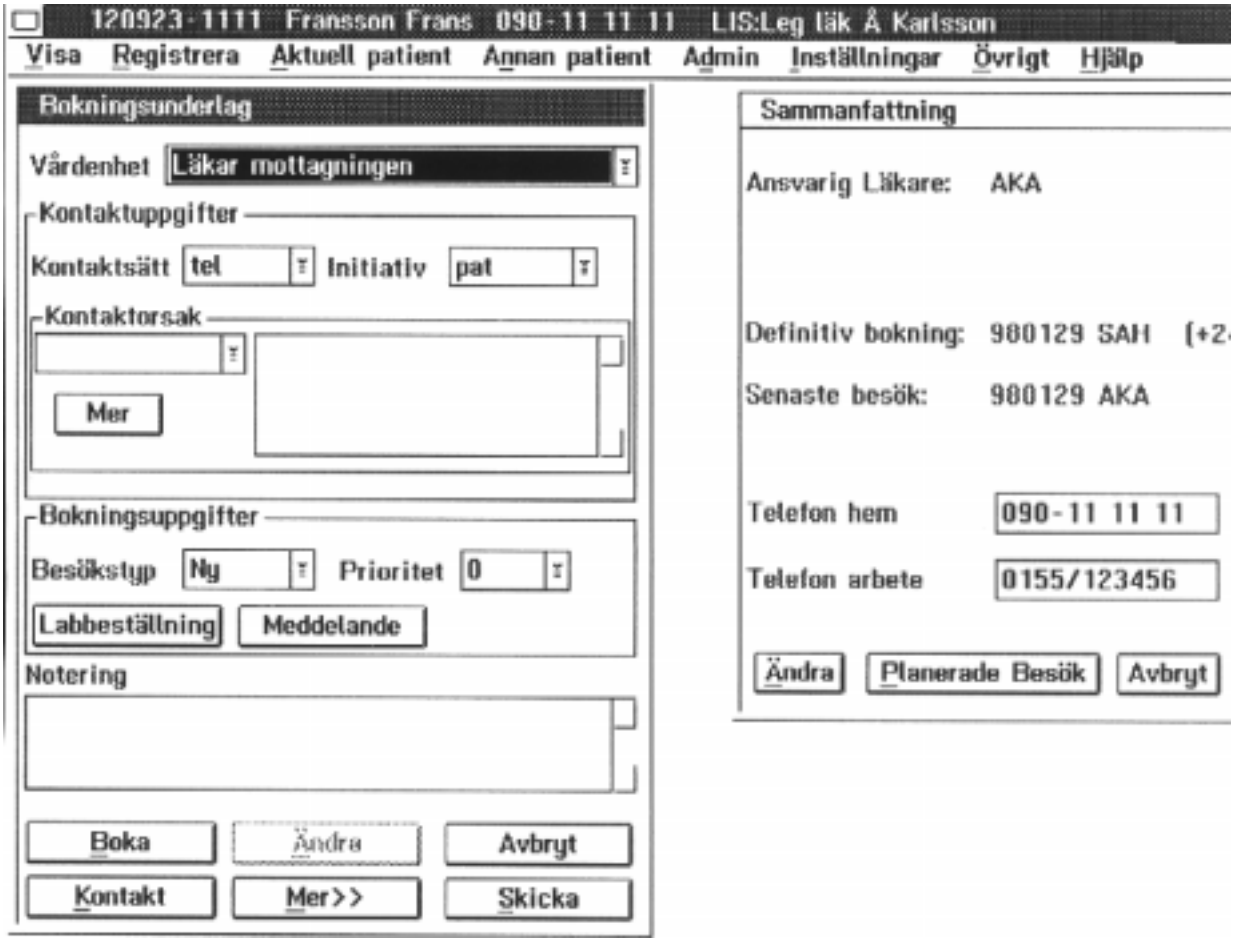


Figure 5.4 Example of a calendar program used at Jonrad. The field "Notering" (English: Notes) is the only text field and it is limited to 200 characters.

5.7 Summary

In this chapter a study of five selected primary care centres was presented. The main object of the study was to investigate the development of the managers' email usage in relation to other means of communication during their first year as email users. The methods used were recurrent interviews and diaries. In order to investigate the context that these managers work in, a survey was also distributed among the employees regarding writing habits, computer knowledge and attitudes.

Of the five research questions in section 5.1, one, the development from novices to experienced users, could be answered only partly in this study. Apparently one year was too short to follow the managers' evolution as email users when it comes to organisation of email messages. However, the possibilities to continue this study with more interviews and a few diary protocols are still open.

The results may be difficult to generalise to other work sites, especially those parts that were influenced by the strict division into different professions. This fellowship among people of the same profession holds these profession groups together across all organisation plans.

Medical service organisations are, when it comes to information technology, generally perceived to be ten to fifteen years behind other sectors such as banking, airlines, and manufacturing (Raghupathi 1997); and parts of the study may therefore interesting for other medical service organisations. It may also be seen as typical of the development during an initial period for organisations with non-technical users where the introduction of email technology is made only to managers.

Email adoption

Email was adopted smoothly by the managers and all respondents were very positive to their new communication tool. One of the most positive features of email for these managers was the reduced cognitive load that email brought when the burden of remembering tasks could, at least temporary, be transferred from their minds to the email system. For managers who are constantly interrupted and have to jump from one task to another this is of a great value. In general email was handled before other tasks.

In fact, the respondents' attitude towards email was so positive that all but one manager allowed incoming email messages interrupt other tasks, although they knew that this behaviour was less rational. For a manager this behaviour is even less undesirable as they all complained about the frequent interruptions of their work that the phone and all their employees caused. A more rational behaviour would be to read incoming email during natural breaks in other tasks. However, the number of incoming email messages was low, less than five a day for three of the five managers, and email may still be considered as a novelty. Incoming messages could therefore be exciting, although this feeling of novelty ought to have decreased after receiving at least one thousand email messages during the study.

Information and communication overflow

The interruptions that the employees caused when they came into the manager's office were the essential part of the communication overflow for these managers, followed by too many meetings. No manager had made any direct attempts to reduce the number of interruptions that employees cause. Two different explanations were given by the respondents: all managers claimed that handling these interruptions and their employees was really what their work was all about, and if they postponed meetings with their staff, this would add to the cognitive load of remembering to get back to these people. Handling the interruptions directly might be more efficient in the long run. The interruptions are, however, a problem. All managers used late evenings or early mornings to be able to work uninterrupted.

These interruptions also make email a more suitable tool than telephone due to the simplicity to interrupt email writing and reading compared to interrupting a phone conversation, and getting back to the subject afterwards.

However, although email has replaced the phone for many tasks and reduced the time wasted in failed attempts to reach people by phone, all managers were aware that

email could not replace the phone completely. Some tasks were better handled by phone, especially complicated or diffuse tasks. This has also been reported by e.g. Daft & Lengel (1984) and Sproull & Kiesler (1991).

Although the usage of email did cause an increase in information that came to these managers in more than one way, the managers in general thought that it was better to handle this information via email as it could easily be deleted. One manager suspected that those that distributed information misused email. The simplicity of distributing information to many people could have influenced these distributers to send information without considering if *all* receivers would benefit from it.

Meetings

Although most managers claimed that there were room for improvements of their meetings, email has not affected these (yet). The internal meetings with the staff were of course unaffected as none of the employees had access to email at the time of the study. The external meetings with the area manager and other primary care centre managers were only affected by the summons and minutes that were distributed via email. The actual meetings had not been affected according to the managers during the second interview, but in the first interview several of the managers mentioned that some issues were discussed on email between these meetings and also that some information was distributed between these meetings instead of at the actual meeting. This may be a change in expressing their usage of email, due to internalisation of this handling of issues between meetings. A large part of their email communication was made with the other primary care centre managers.

Handling the flow of email and organisation of email messages

Problems with handling the flow of email were according to the respondents not directly related to the number of incoming messages but rather to the content of the messages and the nature of other tasks that a person have to take care of.

When it comes to organising email messages, only one of the respondents started using folders during this first year. All other managers claimed that they had a need for more folders, but they did not know at the time of the second interview how to do this. Some managers had made attempts and actually created new folders, but failed to move messages to these new folders. This failure may by attributed to the button in the interface that was used for moving messages to a folder created at the time of installation. This button could only be used for that folder, no new buttons appeared when new folders were created, and left the users without information about how to move messages to other folders.

The folder user complained that he was unable to change the subject line of incoming messages, which is the design in most of the graphical email systems today, and that there was no easy way to separate a message with several subjects into several messages in order to be able to move them to different folders.

Web usage

The World Wide Web was not used at these primary care centres, but was considered as something that would be useful. Especially younger patients came to the centre with

printouts of treatments, drugs, or health programs found on the Web. This caused some problems for the staff that could not check this information and sometimes they had less information than the patient. One of the managers that had access to the Web at home therefore used her home computer to navigate on the Web and brought printouts to work.

Writing habits and computer usage

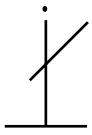
The writing habits observed may be related to computer usage. When the number of words was counted in the open-ended question about computer attitudes in the survey and compared to the answers on other questions it seems as computer usage in general was associated with longer answers, while usage of the calendar program used at these primary care centres seems to be associated with shorter answers to the open ended question.

Attitudes towards computers in medical service organisations

Although the studied managers were positive to email and computers in general, they all complained about their lack of computer knowledge and training programs. They claimed that they knew that if they took time to explore their computer and programs, they would be able to work more efficiently, but still they could not find the time to do this. These attitudes towards computers and training were similar among their employees that in general had a positive attitude towards computers and also asked for more computer education. Similar results have been reported in other studies of medical service organisations in Sweden (e.g. Bovin 1997).

One of the managers was quite dispirited about the future for IT in medical service due to this lack of knowledge among the staff and expected the problem to remain until a new computer trained generation takes over medical service. This change of generations may however take long time. It will take around 25 years before half of the staff at these primary care centres have retired and there were no signs in this study that the need for computer training was less among those that were younger.

The survey did not examine the computer knowledge among these employees, it only gave them a chance to describe their computer attitudes. The feelings of uncertainty and need for more education may be gender related but the vast dominance of women at these primary care centres made it impossible to draw statistically significant conclusions about gender in this study. Their demands for more knowledge should be taken as a positive sign. In the HomeNet Project (Kiesler, Kraut, Lundmark, Scherlis & Mukhopadhyay 1997), those that did not ask for help, were the ones who stopped using the computers.



As described earlier, all conclusions and implications from this study are described in chapter 7 together with the conclusions from the other studies.

6 A Model of the Organisation of Email Messages

This chapter differs from the empirical studies in the previous three chapters, but it draws upon the results and the described problems with sorting email messages. Here, a thought experiment is made in order to create a simple model of time usage for organisation of email messages. This model can be used for time comparisons of different organisation strategies for an individual based on this persons motoric skills. The purpose of the model is to answer questions such as “Would it be time efficient to increase the number of folders?” and “If I spend 30 minutes to clean up my folders and delete messages, would I gain time in the long run?”.

The model is based on keystroke-level analysis and thereby a temporary digression from the attempts in earlier chapters to consider the users’ working context. This model is limited to the context independent aspects of email message organisation. The values of the number of messages, folders etc. are based on the three studies described in the previous chapters 3-5.

This chapter begins with a short description of keystroke-level analysis and then a model of email storage and retrieval are presented. The model is then illustrated with a description of some fictitious users. Finally, a comparison of strategies to organise email messages is presented.

6.1 Keystroke-level analysis

Keystroke-level analysis can be used to estimate how much time it will take for a user to accomplish a given task with a given interface. The analysis can be used to estimate error-free expert performance, but not the time it takes to learn a certain task. The time to perform most tasks can be divided into the time to *acquire* the task and the time to *execute* it. To acquire a task the user must construct a mental representation of the task and choose a method for doing it. To execute a task the user must interact with the computer system. Keystroke-level analysis can be used only to estimate the execution time, not the time to acquire the task (Card, Moran & Newell 1983, p 261). The method have been tested empirically with good results. In Card, Moran & Newell (1980) 28 users performed 14 tasks on 10 different systems and the time usage predicted by the method in general diverted less than 25% from the actual time used.

The execution time of a task can be estimated with the sum of the time for six operators: K (keystroking), P (pointing), H (homing), D (drawing), M (mental preparing), and R (a system response operator), see Eq. 1.

(Eq. 1) Time to execute a task = $T_K + T_P + T_H + T_D + T_M + T_R$

The total time for keystrokes (T_K) can be estimated as the time to perform one keystroke (t_K) multiplied by the number of keystrokes (n_K): $T_K = t_K \cdot n_K$.

The time to move the mouse to point at a target on the screen can be estimated with Fitts’s law (Fitts & Posner 1967):

(Eq. 2) $T_P = A + B \cdot {}_2lg\ (D/S + C)$

where the value of the constants A, B, and C can be determined experimentally; D is the distance to the target and S is the surface area of the target.

The homing and drawing operators are not used in the model below. The homing time, $T_{H,}$ is the time to move the users hand between one physical device and another. The drawing time, T_D, is the time to draw a set of straight line segments.

T_M represents the time the user mentally prepares to execute the physical operators described above. The last operator represents the time for the system to respond to a user action, but is not used in the model below as the system modelled is considered so fast that this time is negligible.

Experiments have been made to estimate values of the operators described above (Card, Moran & Newell 1983). Examples of values are displayed in table 6.1.

Table 6.1 Selected operators of keystroke-level analysis (after Card, Moran & Newell 1983).

Operator	Description	Time (seconds)
K	Keystroke	0.08 – 1.2 average non-secretary typist: 0.28
P	Pointing	$0.8 + 0.1\ {}_2lg\ (D/S + 0.5)$ average: 1.1
M	Mentally preparing	1.35

6.2 Restrictions on the model

The model presented below is a simplification of the real world. The model handles only storage and retrieval of email messages in existing folders and is built on the following assumptions:

- The user does not make mistakes.
- The user is an average non-secretary typist.
- Messages are moved to folders with drag-and-drop.
- Folders and messages have the same size on screen.
- The folder structure is flat (folders do not contain folders).
- The distribution of messages in folders is even (i.e. all folders contains approximately the same amount of messages).

6.3 A simple model of email storage and retrieval

From the studies reported in chapters 3-5 it is clear that the number of incoming messages, folders, and the interface affect the strategies used for storing email messages. A large number of folders increases the time that must be used to store a message, while it may reduce the time to retrieve the same message. If we limit this analysis to mes-

sages that are archived to be retrieved several days later, the total time spent each day on storing these messages can be expressed according to Eq. 3[1].

(Eq. 3) Total time spent storing messages =
# of stored new messages · average time to store one message

All times mentioned in this section are expected mean values. The time spent each day on retrieving messages can be expressed according to Eq. 4.

(Eq. 4) Total time spent retrieving messages =
# of retrieved messages a day · average time to retrieve one message

The total time spent on archiving and retrieving messages is of course the sum of Eq. 3 and Eq. 4 above. The time to switch context from previous tasks or to following tasks is not a part of the model.

There are only two ways for a user to decrease the time spent on archiving and retrieving messages:

1. Increased skills in handling the archiving and retrieving facilities of the mail tool. This will reduce the time to e.g. think about which command to use, where to click, and formulating search criteria.
2. Use of a more efficient strategy for archiving. For a person that has e.g. project specific messages that are stored together in a folder, the time to find certain messages in this folder will probably be shorter than the time that would have to be used if these messages were in a folder with messages regarding other projects as well.

Of these two the choice of strategy is dominant, with the possible exception of beginners. A person that can rely on others to remind him of information in email messages may choose the strategy to simply delete all messages after reading, and thereby reduce the time spent on archiving and retrieving to practically zero. This strategy is possible for only a exclusive group of users and will not be discussed further. Another extreme strategy is to store all messages in the inbox and thereby reduce the time spent to store messages to zero, but this strategy may have the disadvantage of demanding more time when messages should be retrieved and the stored messages are many.

In order to construct a model, we have to limit the world it should describe. In this case the model is limited to graphical interfaces where drag-and-drop can be used to move messages between folders. More limitations are described in their context below.

6.3.1 Storing a message

To store a message, it is necessary to know the name and/or the position of the folder, unless all messages are stored in the inbox. First we have to define *known* and *unknown* folder. A known folder is defined as a “folder that the user knows the position and/or the name of”. An unknown folder is defined as a “folder that the user has to search for”[2]. With the exception of known folders the time to find the correct folder

1. The #-character should be interpreted as “number”.
2. The user may be aware that the folder exists, and will recognise it in a search, but cannot remember the exact name or position by heart.

will increase with the number of folders. During the pre-study of MainframePC respondents described problems with remembering folder names exactly:

> It is always a risk that I do not remember the name exactly, or make a typing error, and suddenly I have another folder with a similar name.

This resulted in users that printed the folder list and taped it to the screen in order to have the folder names visible.

Those that do not use folders do not spend any time at all storing a message, but for users with at least one folder the time to find a folder can be estimated as follows. If we neglect users with perfect memory who never make typing errors, and assume that the folder structure is flat (i.e. not hierarchical), the time spent on finding a folder can be approximated in two different ways depending on whether the name and the position of the folder is known or not.

For an unknown folder the user has to scan folder names one at a time until the searched folder is found. The approximation will therefore be a linear function of the number of folders. On average, half of these folders must be scanned.

(Eq. 5) Time to find an unknown folder = Search constant · # of folders / 2

where the search constant is the inverted number of items (here: folders, further below: messages) on screen that can be processed per second to identify the searched folder.

For a known folder the time to find it can be approximated with Fitts's law.

(Eq. 6) Time to find a known folder = Search constant · $_2$lg (# of folders + 0.5)

The time for finding a visible folder will be a combination of Eq. 6 and Eq. 5. We combine the last two equations in Eq. 7:

(Eq. 7) Time to find a visible folder =
(Eq. 6 · Known folder % + Eq. 5 · (100 — Known folder %)) / 100

The *Known folder %* is the percentage of folder searches that concern known folders.

If the user should search for a folder manually and the number of folders exceeds the number of visible folders on the screen, additional time must be spent to scroll the list of folders. This time is approximated with a constant under the assumption that once the action of moving the cursor to the scroll bar is made, the time for extra scrolling is negligible compared to the time it takes for the user to read the folder names. These two events can also occur simultaneously. We name this time *Scroll constant*. The probability for this, *screenful folder list probability*, can be estimated with:

```
IF (# of folders) < (# of visible folders) THEN
   screenful folder list probability := 0
ELSE
   screenful folder list probability := 1 — (# of visible folders) / (# of folders).
```

This time must be added to Eq. 7:

(Eq. 8) Time to find a folder = Eq. 7
+ Screenful folder list probability · Scroll constant

Finally, the message must be moved to the folder and this time is approximated with a

selection (point and click) and a move (point). In total:

(Eq. 9) Time spent to store a message =
Time to find a folder (Eq. 8) + PKP

In some email tools it is possible to first select the message and then drag it to the folders and by moving the message up or down in the folder list, the list starts scrolling. The term added in the last equation is still a good approximation, as the message still has to be selected (PK) and moved (the second P). It might take additional time to scroll through the folder list compared to "jumping" to a know location of a folder by clicking on the slider. For mathematical simplicity, this type of storing is not handled in the model.

6.3.2 Searching for a message

A message can be searched for manually or by a search function, and search functions can be of many different kinds. Here only two versions will be modelled: search functions that require the user to define the folder to search in, and those that do not require this.

To manually find a message, the folder must be found first (we assume that the message is located in another folder than the currently selected folder). Again this is simplified by not using folders other than the inbox, and the time spent to find a folder can be approximated with Eq. 8 followed by a selection of the folder (PK). Thereafter the folder content must be scanned for the actual message. We assume here that once the folder is selected, the list of messages in that folder becomes visible and that the searched message can be identified without opening the message (e.g. by reading the information in the list of messages), or that the time to open messages during this search is negligible. In many cases the location in the folder of the message will be known and if we assume that the number of searches in a folder is proportional to the number of messages in a folder and that all folders contain approximately the same number of messages[1], we can approximate the search time with Eq. 10.

(Eq. 10) Time to find a known message in a folder =
Search constant · $_2$lg (# of messages/# of folders+ 0.5)

If the location of the message is unknown, on average half of the messages in the folder must be scanned and the time can be approximated with:

(Eq. 11) Time to find an unknown message in a folder =
Search constant · (# of messages/# of folders) / 2

Once again these two equations can be combined if we can approximate the probability of the two different search methods:

1. This simplification gives an upper limit for the time to find a message. Unevenly distributed numbers of messages in folders will give shorter search times (on average), but to estimate that time the distribution of messages on all folders must be known. When searching for messages the inbox should be included in the number of folders.

(Eq. 12) Time to find a message in a folder =
(Eq. 10 · Known message % + Eq. 11 · (100 — Known message %)) / 100

As in the case of invisible folders, there is a penalty if the number of messages in the folder exceeds the number of visible messages and therefore in analogy with Eq. 8, we rewrite Eq. 12 to:

(Eq. 13) Time to find a message in a folder =
Eq. 12+ Screenful message list probability · Scroll constant

where the screenful message list probability is defined as:

```
IF (average # of messages in a folder) < (# of visible messages) THEN
  screenful message list probability := 0
ELSE
  screenful message list probability :=
    1 — (# of visible messages) / (average # of messages in a folder).
```

Folder dependent search tools

A tool search for a message where the folder must be specified can be divided into:
1) Find the folder.
2) Formulate a search condition.
3) Manual search in the resulting selection.

Again, step 1 is described by Eq. 8 followed by a selection of the folder (PK). Step 2 varies between tools, individuals and the current search task, but is in general not affected by the number of messages or folders and can therefore be approximated with a tool and individual dependent *Query constant*.

The third step is depending on how well the search query is formulated in relation to the variety of communication topics and people, resulting in a large or small number of remaining messages. The number of remaining messages is therefore approximated with an individual constant expressed as a percentage of the number of messages that remain on average after a search, the *Remains constant*. The manual search among these remaining messages is linear, and can be approximated with Eq. 14.

(Eq. 14) Time for manual search in selection =
Search constant · Remains constant · (# of messages / # of folders) / 2

Folder independent search tools

For folder independent search tools the method to find a message can be simplified to two steps:
1) Formulate a search condition
2) Manual search in the resulting selection

In the first step, the individual *Query constant* appears again and the second step is the same as Eq. 14, with the # of folders =1.

6.4 Time spent on managing email

In total, the time spent on archiving and retrieving messages can be described by the seven constants in table 6.2 and the four variables in table 6.3. The division into constants and variables may seem arbitrary (and is not important for the reasoning), but the variables are changing over time, while the constants are approximately constant for a person that masters the mail tool. The values of the constants in table 6.2 are estimated from discussions and informal trials with three users.

Table 6.2 Message archiving and retrieval constants.

Name	Description	Typical values
Search constant	Seconds to process one item on screen (1 / # of items processed per second)	0.1-1 (1-10 items/s)
Scroll constant	Time to scroll a window	0.5-5 s
Query constant	Time to formulate a search query	1-60 s
Remains constant	Percentage of messages remaining to search manually among after using a search tool	1-20 %
Screenful constant	Number of visible items (folders or messages) on screen	10-60
Known folder %	Percentage of folders used for archiving with known location or name	50-100 %
Known message %	Percentage of searched messages with known location	50-95 %
Typical values are estimated from discussions and informal trials with users.		

The values of the variables in table 6.3 are based on the numbers given by respondents in the studies reported in chapter 3-5

Table 6.3 Message archiving and retrieval variables.

Name	Description	Typical values
# of incoming	Number of incoming messages that should be stored each day	0-40
# of folders	Number of categories/folders used for archiving messages	0-200
# of messages	Total number of stored messages	0-10.000
# of searched	Number of searched messages each day	0-20
The typical values are extreme values from the studies described in chapter 3-5.		

The number of incoming messages is beyond most receivers' control, but the number of stored messages can be affected by a choice to store all, most, or only some of the incoming messages. The number of folders is under the control of the user, but the number of stored messages is a consequence of number of incoming[1] messages and

1. Note that only the number of incoming messages *that should be stored* is taken into account. Incoming messages that are not stored are not a part of this model.

time. Cleaning habits are not a part of the model, but the model could be used to estimate possible time savings of deleting messages. The number of searched messages is depending of current work task, as some tasks require the user to search for information stored in the email messages, but also on the number of stored messages; a large number of stored messages can be searched more often for information compared to a few messages.

6.5 Application of the model on fictional user data

From the constants in table 6.2 and variables in table 6.3 it is possible to estimate the total time spent to archive and retrieve messages, according to Eq. 3 and Eq. 4. For simplicity, the constants are in the following approximated with the values displayed in table 6.4.

Table 6.4 Message archiving and retrieval constants.

Name	Chosen value
Search constant (from Card et al, p 51, one saccade/item)	1/5 s (5 items/s)
Scroll constant (from Card et al, p 222)	2.6 s
Query constant	10 s
Remains constant	10 %
Screenful constant	30 items
Known folder %	75 %
Known message %	80 %

The influence of the four variables is complicated to display in diagrams. Instead, the only variable that is possible to directly influence manually, the number of folders, is displayed on the horizontal axis, while the other three are selected for some typical user groups.

6.5.1 The evolution of a fictional email user

A new user of email is characterised by a small number of incoming messages (2 a day), few stored messages (50) and few searched messages a day (1). In figure 6.1 the time to store and retrieve a message is displayed as a function of the number of folders. Zero folders are equal to storing all messages in the inbox.

In figure 6.1, find folder is estimated with Eq. 8, store a message with Eq. 9, manual search with Eq. 13 + PK, folder dependent tool search with Eq. 8 + PK + Query constant + Eq. 14, and folder independent tool search with Query constant + Eq. 14 with # of folders = 1.

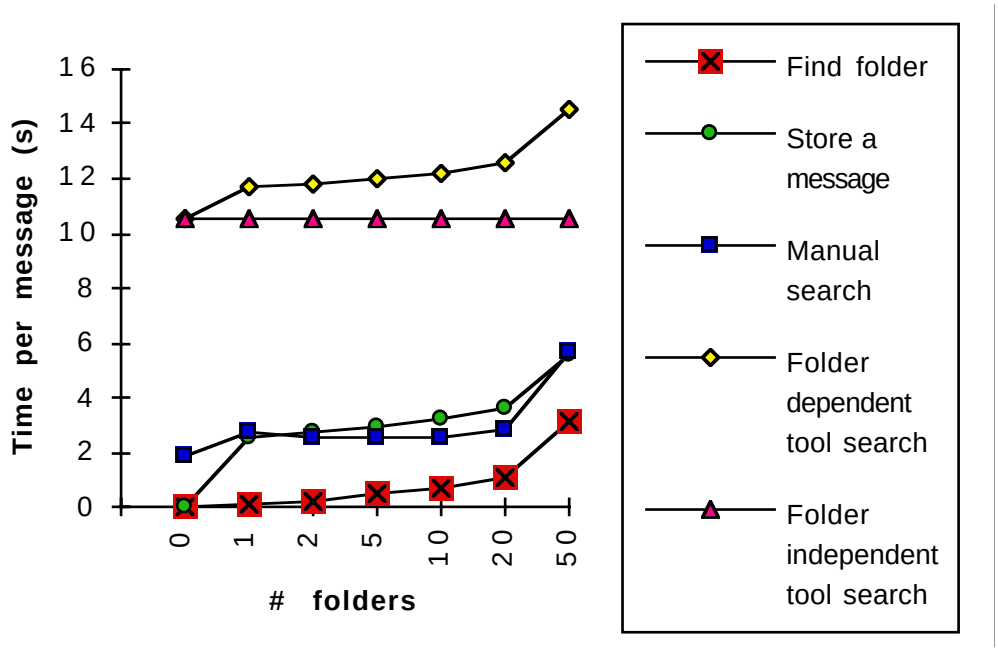


Figure 6.1 Time in seconds to handle one message for a new user. 50 old stored messages.

From figure 6.1 it is clear that the time spent to find a folder increases slightly with the number of folders. This increase in time with the number of folders applies also to the time to store a message, and to use a folder dependent tool to search a message. The time for folderless tool search is of course independent of the number of folders.

When fictional numbers for a new email user are entered in Eq. 3 and Eq. 4, that describe the total time spent on archiving and retrieving messages, we get figure 6.2.

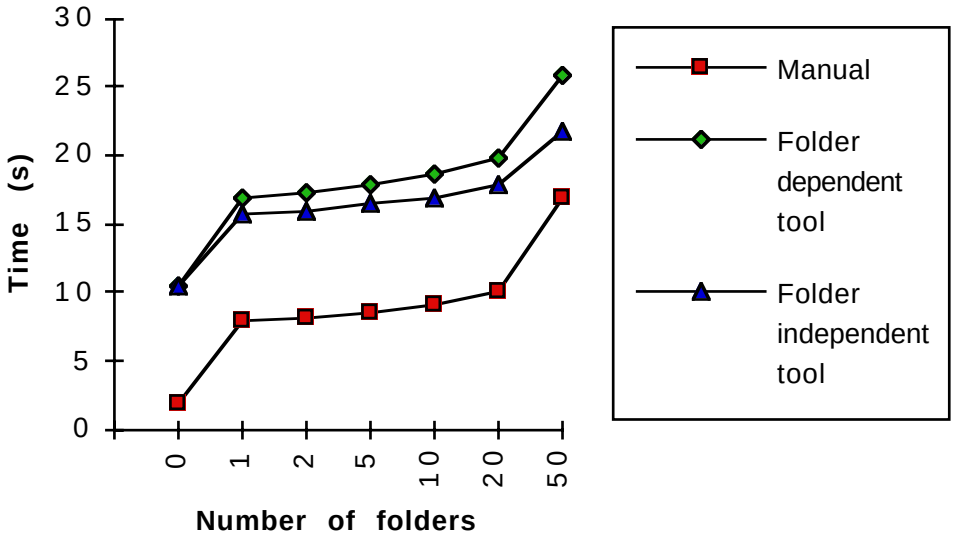


Figure 6.2 Time spent to archive and retrieve messages per day.
2 messages to store and 1 searched message a day, 50 old messages.

The graph in figure 6.2 indicates that the most efficient strategy is not to use folders, and to search manually regardless of the number of folders. Also, the total time is so

small that any of the mentioned strategies is acceptable.

With all numbers equal, except for the number of stored messages that is increased to 200 we get figure 6.3.

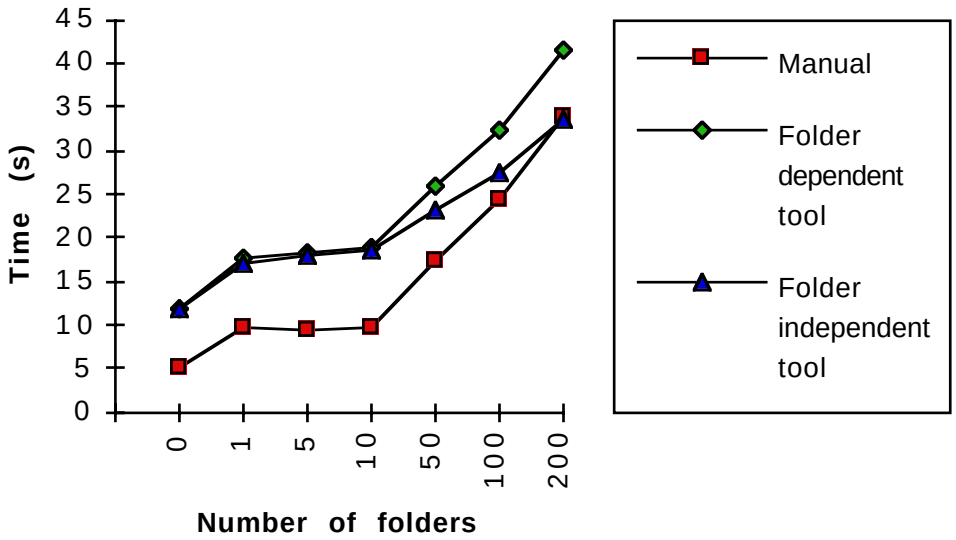


Figure 6.3 Time spent to archive and retrieve messages per day.
2 messages to store and 1 searched message a day, 200 old messages.

In figure 6.3 there is still an advantage to use manual search and it is most efficient not to use folders. If the number of messages searched for is increased to 4 a day we get figure 6.4.

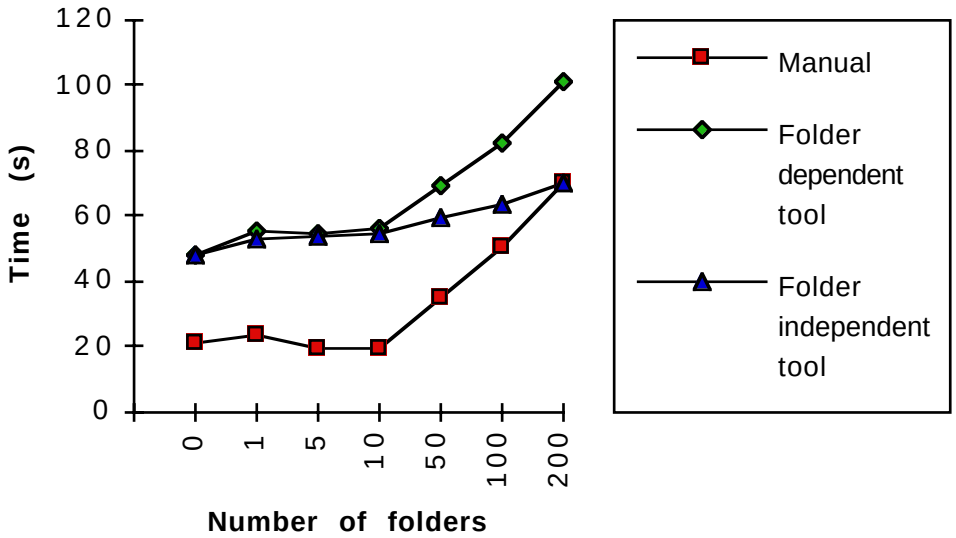


Figure 6.4 Time spent to archive and retrieve messages per day.
2 messages to store and 4 searched messages a day, 200 old messages.

In figure 6.4 the efficiency of using folders is visible for the case of manual search. This may explain in terms of time saving why users start to use folders, although the total time spent is still small for all described strategies. There are other reasons than

time saving to use folders. The concept of using folders is well known from the real world. Few offices are equipped with search tools.

The examples show the properties for a fictional user still developing his email communication. Users with long experience, a rich email communication and many stored messages can also be described by this model. Here we use two of the three categories described by Whittaker and Sidner (1996): No filers and Frequent filers. Their Spring cleaners were omitted due to difficulties with estimating their number of messages to store each day. If we use the average number of messages, folders and received messages for the No filers we get figure 6.5.

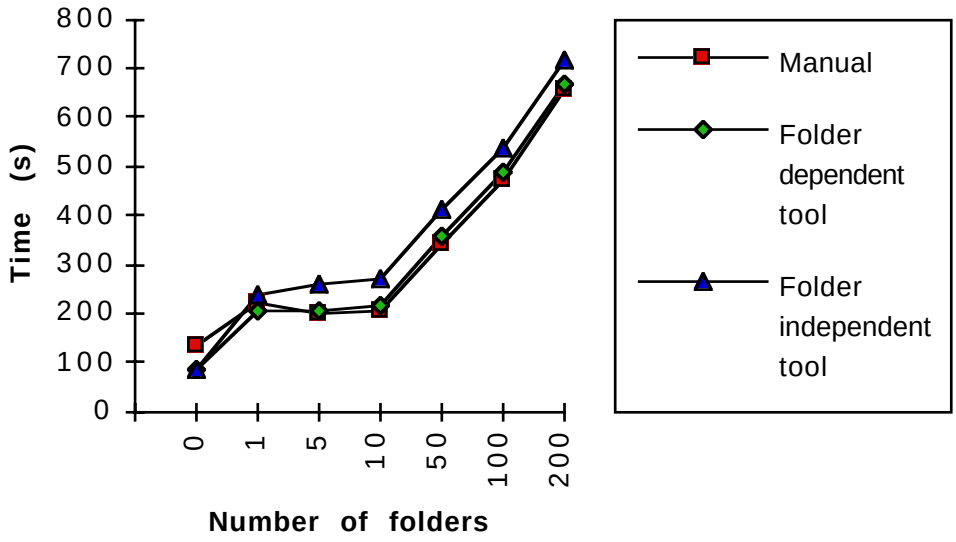


Figure 6.5 Time spent to archive and retrieve messages per day.
No filer. 58 messages to store and 2 searched messages a day, 3271 old messages.

The time spent has a local minimum for 5 folders for manual search. In Whittaker and Sidner (1996) the average number of folders used by the No filers were 6 if the failed folders are deducted from the average number of folders. We can also see that it would be even more efficient to not use any folders at all. If the number of messages to store is decreased to 10, we get figure 6.6.

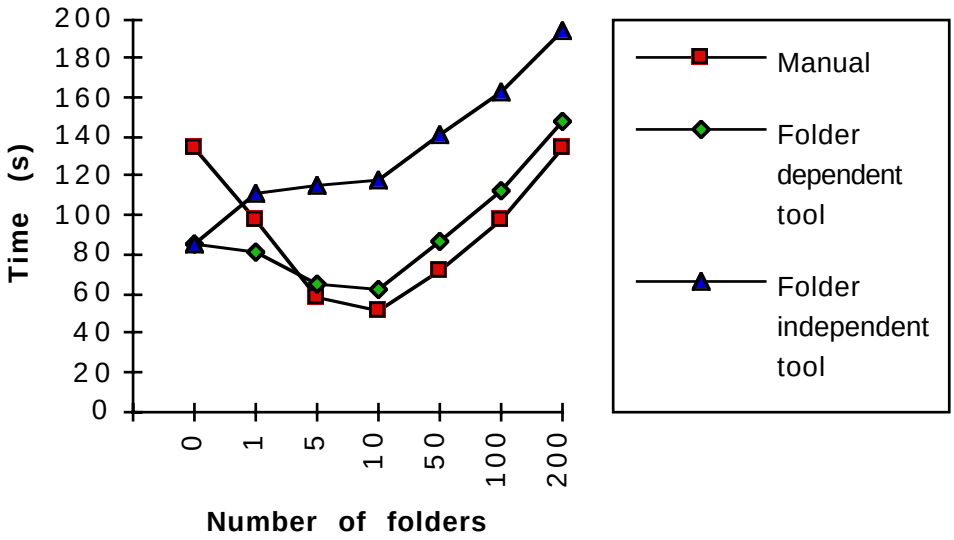


Figure 6.6 Time spent to archive and retrieve messages per day.
No filer with reduced number of stored messages a day. 10 messages to store and 2 searched messages a day, 3271 old messages.

In figure 6.6 we see that the decrease in number of messages to store make a limited folder usage the most efficient strategy. The Frequent filers in Whittaker and Sidner (1996) had on average 1062 messages stored, and if the number of messages to store each day is estimated to 8 (a fifth of the number of their incoming messages), we get figure 6.7.

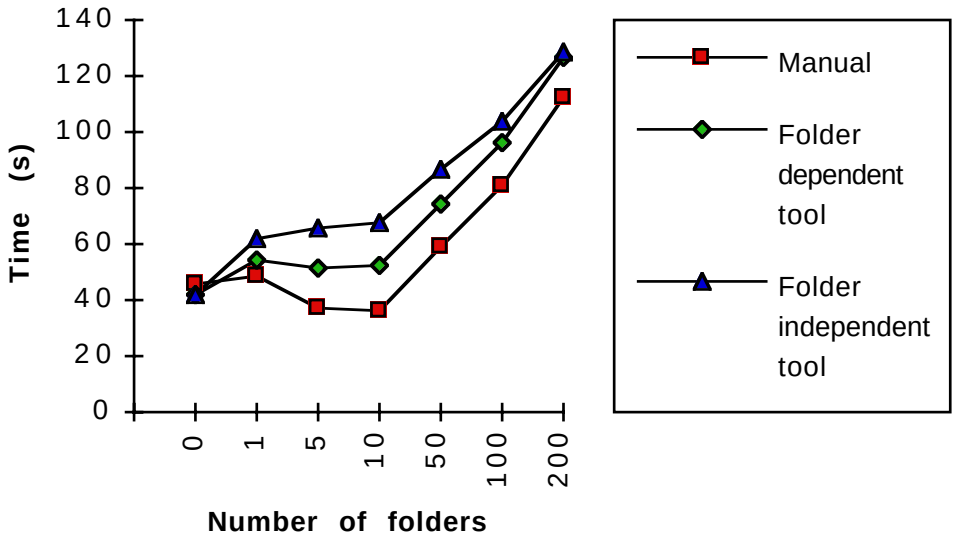


Figure 6.7 Time spent to archive and retrieve messages per day.
Frequent filer. 8 messages to store and 2 searched messages a day, 1062 old messages.

Frequent filers clean their inbox daily, archive messages and use more folders than No filers (average 71 or 54 when the failed folders are deducted) according to Whittaker and Sidner (1996). In figure 6.7 it is indicated that it would be more optimal to use a smaller number of folders, there is a minimum plateau for manual search for 7 to 16 folders.

The no folder strategy is almost as efficient. However, the smaller number of messages that Frequent filers have makes the choice of strategy less important. Also, folders have other advantages that are not visible in this model. A folder provides the user with a context, search for messages belonging to a certain topic is simplified if a folder is used for the actual topic, and cleaning may be simplified when whole folders may be deleted in one stroke.

6.6 Analysis of the model

In what way do the different variables and constants defined in this chapter affect the total times used for handling email messages? In the following two tables these variables and constants are analysed. The analysis is made by changing one variable/constant at a time while other values are held constant. For the variables in table 6.5, these values are indicated as fix values.

Table 6.5 Message archiving and retrieval variables.

Name	Fix value	Extreme values	Influence
# of incoming	4	0-40	A high number of incoming messages that should be stored reduces the differences between the different search methods.
# of folders	10	0-200	The time used for handling email messages is minimised by using no folders or between 5 and 25 folders.
# of messages	500	0-10.000	A low number of stored messages makes manual search more efficient than the tool based searches, especially for the no folder strategy. A high number makes no and few (less than five) folders inefficient for manual search.
# of searched	2	0-20	A high number of searched messages makes manual search efficient, especially for a moderate number of folders (4-50). Few searched messages equalise the different search strategies.

In table 6.6 the extreme values of the constants are analysed.

Table 6.6 Message archiving and retrieval constants.

Name	Fix value	Extreme values	Influence
Search constant	0.2 s	0.1-1 (1-10 items/s)	A high value makes manual search inefficient for no and few folders (<5). A low value makes manual search more efficient than tool based search for all number of folders.
Scroll constant	2.6 s	0.5-5 s	A high value equalises the different search strategies, a low value increases the advantages of manual search, especially for medium to high number of folders.
Query constant	10 s	1-60 s	A low value makes tool search as efficient as manual search, a high value make manual search efficient.
Remains constant	10%	1-20%	A low value makes the folder independent search tool more efficient and a high value makes it inefficient.
Screenful constant	30	10-60	A low number of visible items (messages or folders) on screen makes usage of many folders more inefficient and a high number makes it more efficient.
Known folder %	75%	50-100%	A high value reduces the negative effects of many folders, but many folders (>50) are still inefficient.
Known message %	80%	50-95%	A low value makes manual search for few folders (<5) inefficient, a high value the opposite for the same number of folders.

Where should the efforts be made to facilitate for the user to archive and retrieve messages? If the time is divided into time to store messages and time to retrieve messages for the three described retrieval strategies we get figures 6.8, 6.9, and 6.10.

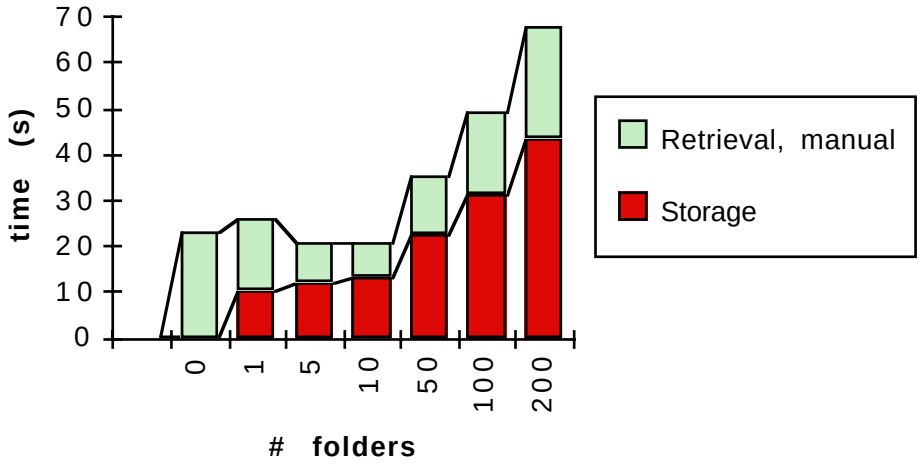


Figure 6.8 Time for storage compared to retrieval. Manual retrieval. 500 stored messages. 4 messages to archive and 2 to search.

For manual retrieval, the time for storage is the dominant factor for all number of folders, with the exception of no and one folder. More messages stored increase the time to retrieve messages for few and no folders.

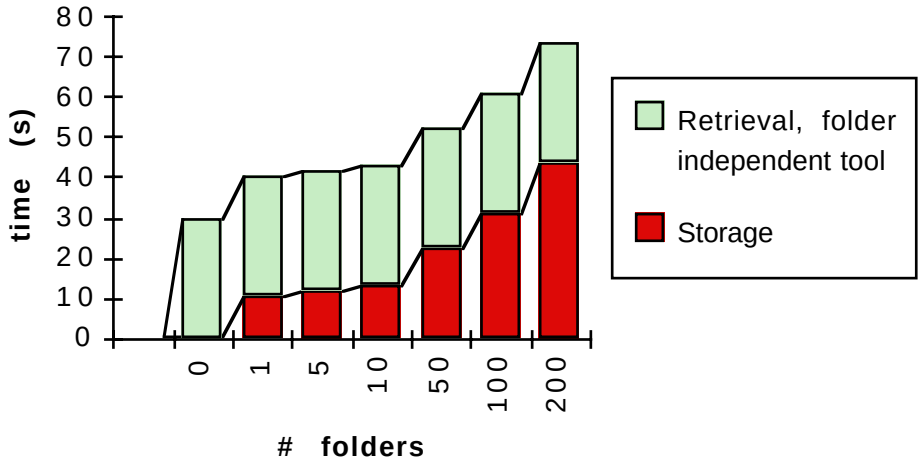


Figure 6.9 Time for storage compared to retrieval. Folder independent tool retrieval.

For a folder independent tool retrieval, the time for retrieval is the dominant factor for all number of folders up to 100. A larger number of stored messages increases the retrieval time for all number of folders.

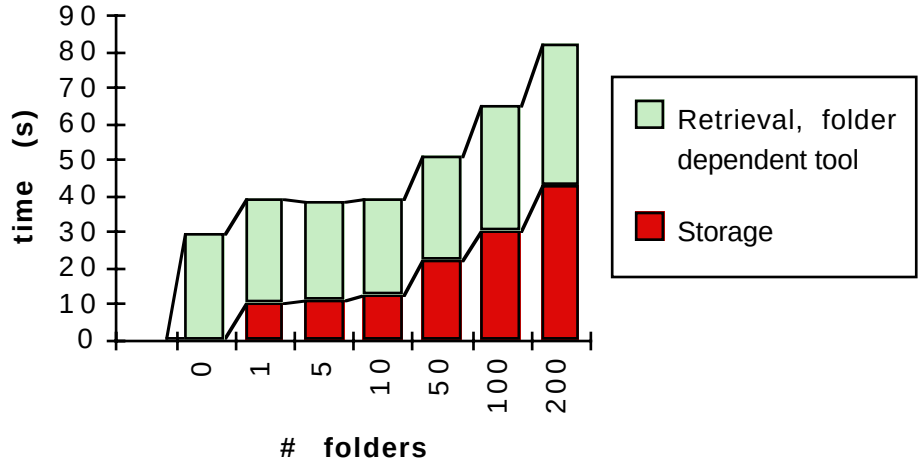


Figure 6.10 Time for storage compared to retrieval. Folder dependent tool retrieval.

For a folder dependent tool retrieval, the time for retrieval is the dominant factor for all number of folders up to 50, with a larger number of folders storage time becomes dominant. A larger number of stored messages increase the retrieval time especially for few and no folders.

6.7 Summary

I have presented a model that describes some of the context independent properties of email message storage and retrieval. The model has been illustrated with fictional user data to describe the influence of essential factors such as the number of incoming messages to store, number of folders, the total number of messages, and the number of searched messages each day. The model has also been applied to user categories described in Whittaker & Sidner (1996) and used to predict the behaviour and choice of strategies for these categories. Finally, by studying the relation between time spent on archiving and retrieval, the importance of improving the facilities for archiving messages for those that search manually, and the search tools for those that use them have been demonstrated. The model could be further developed for example to include cleaning in order to answer the question: Is it efficient to delete old messages (besides the fact that disk space may force some users to do that)? For example, one of the participants in the informal trials could according to the model save a minute a day if he reduced the number of stored messages from 5000 to 2500.

One weakness of this description is that the model has been tested empirically with only three real users. These informal trials confirmed the model's prediction of these users time usage, but the model underestimates the time usage for searches among many messages with the same subject. These messages appear identical during the the search and this increases the time it takes to identify the searched message. Further work should include a large number of users with varying strategies.

There are limitations of the model: usage of folders is not affected only by efficiency of storage and single document retrieval. Folders provide users with a context, and may be used to group messages that are difficult to search for with a tool, but still must be read together. Also, folders may in some tools be used in a hierarchy, and the model does not consider that at all. Neither does the model handle mistakes by the user such as searching in the wrong folder for a message. The folder independent search tools are not effected by this and would be more efficient compared to the other two methods if this was taken into account. The model does not include system response time and for most of the modelled tasks this is fine, but for users with many stored messages who use a folder independent tool, it is clear that this time might be considerable.

However, the model seems to predict some aspects of the behaviour of email users, and their development of strategies (conscious or not). The model could be used to predict the development of email users' folder habits, as described in chapters 4 and 5, and the number of folders used by one of the strategy categories in Whittaker & Sidner (1996).

The many individually dependent variables and constants in the model make it difficult to state general conclusions that would hold for all users. It is also possible to generalise the model further by introducing more variables and constants. For example, the number of visible folders does not have to be the same as the number of visible messages. But for users with "normal" values on the described variables and constants the following properties hold for the total time for storage and retrieval:

- no folders is an efficient strategy as long as the number of messages is less than a few hundred,
- zero to three folders are less efficient than four to approximately twenty folders for manual search,
- the strategy to use many folders (approximately 30 or more) is not efficient according to the model, regardless of the values of the variables and constants,
- for many users, the time differences between the different possible strategies are insignificant,
- the gain in time a reduced number of stored messages give is less than a few minutes a day for many users (i.e it is inefficient to do clean-ups),
- a folder dependent search tool is more efficient than a folder independent one.

The implication that the most efficient strategy for many users would be to use no folders raises demands on search tools that must be as easy to access and use as folders. Tailorable search conditions accessible from a menu could reduce the time to search for messages dramatically.

7 Conclusions and Design Implications

In this thesis email usage in three different organisations has been studied: an academic research laboratory, a technical company, and five primary care centres in a medical service organisation.

The main research issues, as described in chapter 1, were email usage from an individual perspective; managers' email communication; the relation between email and information and communication overflow; organisation of email messages; and the differences between novice and experienced users' email usage. Summaries and conclusions regarding these five issues are described in separate sections (7.1 to 7.5) below, followed by a section (7.6) where design solutions are suggested to some of the problems discovered in the studies.

Methods used for the studies

All three studies were based on interviews and surveys. In the two last studies, diaries were used in the longitudinal case studies. At the academic research laboratory a survey was made among all members of the laboratory. All 28 respondents had used email for several years, and almost all had a technical background. These surveys were followed by interviews in the research laboratory, but also at other sites to achieve a variety of users. In total, twelve email users were interviewed.

At MainframePC[1], interviews were made with nine respondents in a pre-study. Then a survey was distributed to 116 randomly selected people, comprising 16% of the company's staff; 81 responded (70%). Finally three employees were followed more closely for one year with interviews and diary protocols in an longitudinal case study. In this company, all respondents had a technical background and had used email for several years.

The Jonrad study consisted mainly of five primary care centre managers that were followed closely during one year in a similar way as the three selected employees in the longitudinal case study at MainframePC. None of the respondents had a technical background. The study was concluded with a short survey to all 138 employees at these five primary care centres. Only the managers used email, and they had only done this for a few months at the beginning of the study.

In many cases there are similarities between the users in the three studies, and conclusions based on these similarities may hold for other organisations as well. However, when conclusions are made from the differences between the users in the different studies, they must be made with caution. The differences may be caused by the context of use, email systems, work tasks, or computer and email training and experience. These differences are nevertheless interesting, especially when they illustrate the special situation for managers, as described in section 7.2, or differences between novice and experienced users, as described in section 7.5.

1. For the sake of anonymity the technical company is here named MainframePC and the medical service organisation Jonrad.

7.1 Email usage

According to the respondents in all three studies, electronic mail has several advantages compared to other media. The asynchronousness, group addressing, and automatic documentation compared to telephone; the speed of delivery and simplicity when it comes to envelopes and mailboxes compared to paper mail. However, email is not superior to other media for all means of communication, e.g. telephone is better for handling complicated or diffuse tasks. These differences have been reported by many others (e.g. Sproull & Kiesler 1991, Palme 1995, see also section 2.4 in this thesis) and are not further discussed here.

7.1.1 Cognitive comfort

In the Jonrad study described in chapter 5, another advantage of email emerged: the cognitive advantage of not having to remember things. The respondents expressed this mainly for the outgoing messages when a task could be removed from their own work schedule and be “put on someone else’s desk”.

Incoming email messages also reduced the cognitive load for the respondents to remember things since they formed a to-do list automatically. New tasks that were given to them orally had to be remembered or written down. For a manager that often rushes from one task to another this is often impractical, and oral messages are forgotten and paper messages lost. Email messages gave cognitive comfort both to the sender and the receiver as they both knew that tasks handled via email would not be forgotten or placed under a pile of paper. Another advantage of email was that tasks that arrive via email were possible to handle via email to a great extent. Paper and phone messages may often result in extra work to contact the originator of the message. E.g. when a manager was asked if they could spare a doctor a certain day, the issue could be handled in a few seconds with email, but may take several minutes if the manager has to call back several times. To spend several minutes just to answer “no” to such a question is probably a waste of time.

Why was it only the participants in the Jonrad study that described this advantage with email? There are at least two explanations for this. These participants fulfil two conditions: they had recently started to use electronic mail and they were managers. Those that are new to electronic mail are more likely not to have internalised their usage and thereby their opinions about electronic mail. The cognitive comfort was not internalised by these new users, they were still thinking about the time savings and reduced number of tasks to remember that email had brought to them. Studies of managers show that they communicate more than employees and that they are often interrupted (Carlson 1951; Stewart 1967; McCall, Morrison & Hannan 1978; Edlund 1990; Tollgerdt-Andersson 1995). Altogether, this makes the cognitive comfort that email brings more important for these managers.

Also, this cognitive comfort exists only when senders of messages can be certain that the message *will* be handled by the receivers as they could in the Jonrad study. If some of the receivers do not act upon incoming email messages, this advantage disappears, and senders must use other strategies to achieve this comfort. One example is sending carbon copies to managers as the subjects in the longitudinal study of Main-

framePC did when they realised or suspected that the receiver would not handle the message otherwise.

One design solution for handling this problem is to warn a user sending a message that receivers have not read this message for some time, similar to the vacation facility that exists in some email systems, but with the difference that it automatically answers during receivers' longer absence from the email system. The definition of "longer" in this case could be made by the sender, as it is the sender who has the interest of information in case the message is not read. Another interesting information could be the frequency of which the receiver has read email in e.g. the last week.

7.1.2 Balanced behaviour

The respondents in the longitudinal case studies at MainframePC and Jonrad Primary Care Centres mentioned that there were certain tasks that fit email particularly well: non-urgent short unambiguous questions, answers to such questions, and one-way information. In these cases email can save time and money by replacing other means of communication (Peckham 1997, p 353). There are also certain tasks that the respondents describe email as unsuitable for: emotional, unclear, or long discussions. In-between these two groups there are a wide variety of tasks that email could or could not be suitable for. The email user therefore must make a choice of when to use email or not. There are several occasions when this choice is not obvious. In table 7.1 to 7.3 possible extreme strategies for sending, replying, and answering messages are contrasted towards each other. In the tables the advantages of the two extreme strategies are displayed.

Table 7.1 Advantages of different strategies for sending email messages.

Always/often send email messages	Seldom/never send email messages
• No/less waiting in telephone. • No/less time searching for people. • Automatic documentation. • Improved relations due to more frequent contact. • Time to analyse and rewrite messages before sending.	• Improved relations due to more personal contact.

The two extreme strategies to send messages are: always use email to communicate and never use email to communicate. The respondents in the longitudinal case studies describe several advantages with using email as often as possible[1], as displayed in table 7.1: no time has to be spent waiting in telephone for the receiver to pick up, or hang up if the line is busy; no time has to be spent on tracking people that may be on vacation or working at other places than their "normal" work site (at MainframePC employees could be working at customers' sites, at Jonrad many of the employees worked at several different sites within the organisation); email provides the users with

1. Assuming that receivers respond to email messages within a reasonable time period.

an automatic documentation of both on-going work (to-do lists) and concluded work (decisions and agreements in writing); several of the respondents had noticed that email could be used to maintain closer relations with more people by sending short non-urgent messages (e.g. asking about health conditions). The two younger respondents in the MainframePC study used email to handle much of their relations with friends both at and outside the company. The importance of the possibilities to analyse and rewrite messages before they are sent were not described by the respondents, but has been suggested by Bowers & Churcher (1988) as one important part of asynchronous systems.

On the other hand, the respondents regarded email as somewhat cold, in the sense that it limited their possibilities to express and register emotions. This phenomenon that email is considered "cold" may be related to the characterisation of email as "lean" according to media richness theory (Daft & Lengel 1984; Markus 1994b, see also section 2.4.1 in this thesis). Several of the respondents therefore used the telephone, or visited people in person, deliberately although the "official" business they handled could be expressed in a short email message. The reasons they stated for this behaviour were a need for more personal contact.

Table 7.2 Advantages of different strategies for reading email messages.

Frequent reading	Less frequent reading
• Constantly informed. When meetings and work tasks are cancelled, this strategy can save time. • Awareness of co-workers current tasks and presence.	• No interruptions of other tasks by incoming email messages and thereby time saving.

The two extreme strategies for reading email are reading messages as soon as possible (e.g. by reading messages immediately when they arrive and as soon as you have access to the email system) and not reading email at all. The last strategy was not used by any respondent in these studies, but a few users read email only weekly.

The advantage of frequent reading of email described in table 7.2 is the immediate access to new information. In some cases this can be time saving when e.g. meetings are cancelled or postponed in the last minute and email is used to quickly inform the participants. For the managers in the Jonrad study this was important as they often had to spend 30-60 minutes travelling in one direction to get to these meetings. The frequent reading of email messages and acknowledgements of reception can also be used to create an awareness of co-workers, although email may not be the optimal tool for this (see Whittaker, Swanson, Kucan & Sidner 1997, and section 2.2.4 in this thesis).

On the other hand, if every new arriving message causes an interruption of other work tasks, the time spent to resume the interrupted tasks may be significant. This time depends on the task but also on the computer: a computer with insufficient memory capacity for the running applications may use minutes to switch between applications. For the respondents in the Jonrad study several applications were password protected, due to sensitive patient data, which prolonged the time to switch application even further.

Table 7.3 Advantages of different strategies for replying to email messages.

Immediate/fast reply	Slow/never reply
• No/less unexpected visits and phone calls causing unwanted interruptions. • Short inbox, that follows from the possibilities to delete replied messages, gives a better overview of messages and may reduce cognitive stress of having many things to do.	• Time saving for tasks that solve themselves. • No interruptions of other tasks by incoming email messages.

The two extreme strategies for replying to email messages described in table 7.3 are immediate/fast reply and slow/never reply. The advantages of answering email immediately are shorter interruptions and possibilities to reduce the number of messages in the inbox. If a message is important to the sender and the reply does not arrive within a reasonable time period, the sender might use other means to get an answer. Phone calls and unscheduled visits may cause interruptions much longer than the time it would have taken to answer the email message in the first place. Also, the number of messages in the inbox can be reduced because this strategy simplifies deletion of the answered messages (see also section 7.4.1) which may reduce the risk of missing messages and increasing the possibilities to use the inbox as a to-do list. If the number of messages in the inbox becomes large, users may become stressed. This was reported from users in all three studies. The amount of messages required to stress users is individual.

On the other hand, the strategy to answer email messages infrequently or not at all may also be time saving. Less time is used to switch between tasks, and in some cases tasks described in a message may be solved without participation of all recipients. For example questions that only need one answer can be directed to a group of people. A person using the strategy to answer seldom has the advantage to see if someone else has answered the question first.

The strategies described above are independent of each other, with the exception of immediate/fast reply that must be combined with frequent reading. An email user could send email often and reply to others seldom, or send email seldom but reply fast to incoming messages. It is possible to switch between these strategies and even have a different strategy for each message. The tables above describe the consequences of these strategies in the long run.

Each user must find his or her own balance among email and other means of communication, but one should be aware of the consequences and make this choice deliberately. It is impossible to say that any of these strategies are superior to another, it all depends on the user and the user's situation. The strategies involved in sending and replying to email messages often depend on the receivers' reading frequency. The strategy to read email often is successful only when other people send messages with valuable information.

7.2 Managers' email usage

Managers in these studies were busy people that used email frequently but also used longer time to answer their email compared to the employees. The managers in the MainframePC study participated in more meetings and used email more than others. Phone usage did not differ between the different positions (employee, project manager, group manager, and high rank manager). The media to handle the increase in communication that followed a higher position were most of all email and meetings. Therefore it is essential that managers can handle their email tool to its full extent.

7.2.1 Managers' communicative situation

Previous research (Burns 1954; Stewart 1967; Lawrence 1984) has shown that 60-80% of a manager's work time is used for communication, which was confirmed in this study. Meetings, planned as well as spontaneous, take a major part of the day. The large number of spontaneous meetings increases demands on "free time" in the schedule and reduces the possibilities to work undisturbed for a long consecutive time, which demands flexibility from managers to reschedule meetings and other activities.

There are two ways to reduce the time spent in meetings: reduce the number of meetings and reduce the length of each meeting by making the meetings more efficient. Darr (1996) suggests that the number of meetings can be reduced and become more effective with the aid of a groupware system:

> People are coming to meetings better prepared. Tangential issues which used to side-track meetings can now be discussed via Notes prior to the meeting. Also, there is a better follow-up after meetings. Before Notes, people would forget who was supposed to do what. Now, there are records that remind people when and what they are supposed to do (p 77).

The problems mentioned can also be reduced by better organised meetings and minutes that clearly state who should do what, but asynchronous groupware systems may also facilitate discussions between people separated geographically and/or are difficult to gather in a room at the same time.

However, none of the respondents in the longitudinal studies could mention any impact that email had on the actual meetings with the exception of fewer meeting participants claiming that they had not seen certain documents. Not surprisingly, a groupware system is not enough to change the meetings, it is just a tool to support changes. This lack of change may also be explained by a high efficiency in the meetings that these respondents participated in, but several respondents had complaints about the way these meetings were performed.

Kraut, Egido & Galegher (1990) have investigated empirically how often people collaborate depending on whether people work in the same corridor, on the same floor, on different floors, or in different buildings. They interviewed 90 researchers involved in collaboration in social psychology, computer science, and management science; distributed a survey to 66 psychologists; and made an archival study of 93 members of an research and development organisation. Results show that the closer people are located, the more they collaborate, and Kraut & Galegher argue that the possibilities to discuss informally are important for cooperation.

The informal discussions that occur at meetings can therefore be as important as the issues handled according to the minutes. Thus, it is uncertain if more effective meetings would be an improvement of managers' total situation. Efficient meetings would be shorter, which would be an improvement; but if more time has to be spent outside meetings to handle the informal discussions it is questionable if there will be any time savings at all.

7.2.2 Managers' email usage

Besides the more extensive email usage, managers in the MainframePC study also stated that they had a need to read email messages at other sites than their ordinary workplace. The many messages handled by managers increase demands on the email system to give possibilities to write email messages fast (e.g without waiting more than a few seconds for a program to start), and to facilitate for managers to communicate via email regardless of location. Some email tools (for example Eudora, and Lotus Notes) have facilities to allow the user to write messages while the computer is disconnected from the net to reduce the number of tasks on the to-do list. This is important, but so are the possibilities to access the net at different locations to maintain on-going discussions.

Email was so popular among the managers in the Jonrad study that they handled email messages before other tasks, sometimes to their own surprise. Explanations may be that the tasks they handled with email could be done swiftly, as they did not have to search people on the phone or handle complicated or sensitive issues.

In the pre-study of MainframePC, the "cc-disease" was mentioned, that is that many "just in case" sent a carbon copy (cc) to their managers, and some managers felt that this caused many un-necessary email messages. This study implies that the time saved by eliminating these messages is limited (5 to 20 minutes a day in this company), but for some managers this may be valuable time.

However, the employees did not send carbon copies without a reason. None of the respondents in the longitudinal study of MainframePC used carbon copies at all in the beginning of the study, and when they did so at the end of the study they had reasons for it: making others do what they should and to keep their own back free. They had all noticed that some people did not do things when they were asked to, unless the request was sent with a cc to a manager. An example of keeping one's own back free is when a respondent were forced to break the rules for testing a piece of software due to time constraints. She sent an email message to the person responsible for the testing with a written version of the oral agreement she had made with the same person in order to have recorded "evidence" of the issue.

Peckham (1997) gives another reason for these seemingly un-necessary messages to managers. In an ethnographic five-month case study of two managers they used email as one way to "create a textual presence for themselves" by sending email messages to other managers describing what they were doing. This was considered as important in order to "climb the corporate ladder".

There are other ways for the senders of email messages to ascertain that their messages will be handled. Acknowledgements of reception worked both in Notes and

MMC as a pressure for receivers to handle messages as they knew that others knew that they have read (opened) the message. A clear policy for how email should be handled in an organisation in combination with time to handle email messages could also help. The shared databases in Notes could also be used to support work flow and make it clear who has done what.

7.2.3 Uninterrupted time for managers

Miyata & Norman (1986) describe two different ways to handle tasks: task driven and interrupt driven. When people work in a task driven way, they focus on one task and ignore other events; when they work in an interrupt driven way, they change activities frequently to respond to new events. All people use both, and both have advantages and disadvantages. Task driven handling requires possibilities to queue incoming tasks, while interrupt driven handling requires support for re-starting an interrupted task. Leadership research describes how one of the major problems for managers is that they repeatedly are interrupted, and get too short periods of consecutive undisturbed time. It would therefore be an advantage if managers could work more in a more task driven way in certain situations.

One of the major advantages with email is that the communication is asynchronous and therefore facilitates task driven processing. However, half of the respondents in this study stated that they checked their email continuously and allowed incoming messages to interrupt on-going tasks, which means that the communication becomes more synchronous. Berghel (1997) describes the demands from incoming email messages:

> One normally can't ignore email, as one ignores the telephone, without the potential of repercussion – even if it's unsolicited and from a stranger (p 50).

Why cannot, at least managers, wait until an natural break to handle incoming messages? In the Jonrad study managers described their excitement in attending to incoming messages; even after one year and more than one thousand received messages. Similar results for non-managers occur in Lantz (1996) and in the study of the academic research laboratory in chapter 3. In fact, many respondents thought that these interruptions were valuable. The interruptions were described with expressions as "necessary micro-breaks" and "it is fun to receive email".

Although it may be fun to receive email, it is questionable if it is rational to repeatedly be interrupted by incoming messages. The managers in the Jonrad study admitted that it was unwise to handle incoming email messages in this way.

Managers in the MainframePC study allowed incoming messages to interrupt them to the same extent as employees – the higher position had not changed their behaviour, despite their need for uninterrupted time. One explanation for this is that they handled incoming email messages in the same way as telephone calls, and answered everything with an audio signal immediately. By using email asynchronously, instead of synchronously, they could reduce the mental workload as well as the number of interruptions and task switches.

There existed no company policy for email usage at MainframePC. A clear policy that states how often an employee is expected to read email could reduce the pressure

to answer immediately, and reduce the number of context switches that occur when a person interrupts the current task to read a newly arrived message. For managers this can be particularly valuable to increase the consecutive undisturbed time that they need. It is especially important to give managers support to handle their situation considering all people that are depending on managers abilities to handle their communication.

At Jonrad there existed a policy that the email system should be checked at least once a day for new messages. With the increased number of messages that will come when the employees also get access to email, it might be necessary to also recommend an upper limit of the number of accesses to the email system per day. However, as described in 7.1.2, access to the email system is a matter of balance between interruptions, awareness, and time constraints depending on the individual users' work context.

One way to reduce the number of interruptions is to remove the signal that notifies about new incoming messages. However, when the user is expecting an important and urgent message from someone it must be possible to instruct the email system to notify only when e.g. an answer to an outgoing message is returned or any message from a certain person, or a group of persons.

Different priority classes for email is a possibility; an example from the computer company Tandem is described in Sproull & Kiesler (1991, p139). At Tandem, email messages were categorised in three priority groups: first class for person-to-person messages, second class for distribution lists, and third class for extracurricular messages.

7.3 Information and communication overflow

Each tool affects its users by its possibilities and limitations. This includes email tools that affect how we write and communicate with each other. In this section problems with information and communication overflow are discussed.

7.3.1 Information overflow

All respondents in the longitudinal case studies experienced information overflow. At MainframePC this overflow occurred occasionally, but the managers in the Jonrad study were constantly inundated with information. In both these studies the main source of information overflow was the paper communication, mostly advertisements, but email could also be a part of this overflow, especially at MainframePC when the same information came through several different channels (the different email systems, electronic bulletin boards, and the Web-based intranet).

Handling the information flow is a question about balance. Too little information can be worse than too much. Ideally, the information flow should consist only of the information that the receiver wants. Below are some remedies for the email information flow.

In order to reduce the email overflow it is important to reduce the number of unwanted messages. This can be done by reducing the number of sent messages by an

improved precision in addressing messages. In the Jonrad study, many messages were interesting only to certain professional groups and should therefore only be distributed to the work sites that have these professions. In the future, when all employees have access to email, these messages should be sent only to employees within these groups.

This idea of improved precision is possible to extend. Instead of sending vast amounts of organisational information blindly to all employees, the database with all user names could be extended with fields describing their interests or specialities. This would provide the distributor with possibilities to use database facilities to construct distribution lists even for a single message. For example a list could be constructed that includes those that use C++ on PCs, but not on mainframe computers when information about a new PC development environment arrives.

The difference between this suggestion and ordinary distribution lists is that ordinary distribution lists require the intended receivers to sign up for broad pre-defined topics. This suggestion allows receivers to define the topics to a greater extent, and distribution lists may be created for a single message.

This solution is not as ingenious as the filtering in Information Lens (see section 2.2.6) or agents that both block uninteresting information and search for interesting information among messages that are addressed to anyone, but it is practical when such tools are not available.

For individual users, unwanted email messages with advertisements or chain messages are mostly annoying and not so time consuming, as it is fairly easy to identify messages as advertisements and delete them. However, for an organisation the time wasted in total by all employees may be significant.

The suggestion by Hall (1998) to use different channels for sending email messages and thereby preventing address collectors on the Internet to get hold of email addresses is advanced and would diminish the problem with unwanted email advertisements.

External email messages with advertisements and chain messages could be deleted at the email server and thereby never reach most email users in the organisation. The problem of identifying these among other messages could be handled by assistance from the employees in the organisation. When an advertisement or chain message is discovered by an email user, the user could send a default message to an address within the organisation, that result in all messages with the same advertisement being removed from the organisation's email servers. Similar suggestions are discussed in Cranor & LaMacchia (1998). Advertisements and other un-interesting messages could also be filtered into a separate folder as suggested by Davis & McManus (1995).

In some cases messages are sent to a distribution list asking for information that a vast majority of the receivers do not have. A part of these messages could instead be directed to a "switch board" where these messages could be manually redirected to receivers that have the wanted information (automatic redirection has been tried unsuccessfully in the Messages system described in section 2.2.7). Again, the database suggested above could be useful.

There are problems that neither Information Lens, Hall channels, nor any other kind of software can solve: some users do get many email messages that they want, or have to, read and answer. Those that received many email messages in the study of the academic research laboratory expressed a need to process messages fast. Although not

solved by software, the handling of these messages may be facilitated by one-button keyboard commands to delete or move messages and default answers to handle large number of messages about the same topic.

Most email users have experienced that someone has used the “reply to all” command instead of the “reply to sender” by mistake. Although this is not so problematic for the receivers as it is embarrassing for the sender of the reply, improved feedback that made it clear to the replier that this message will be sent to several people could reduce the number of mistakes. Also, a warning could be issued when a “reply to all” results in more than a certain number of messages. The exact number will differ between individuals depending on their habits to send the same message to several recipients.

Separating email messages into classes with different priority is not a new idea (cf. Sproull and Kiesler 1991, pp 139), but is becoming more important to facilitate for the user to handle the increasing email flow. Regardless of priority system it is important to have informative subject lines that facilitate browsing and identification of messages. This would also facilitate organisation of email messages.

Information that should be stored for a longer period of time should not be distributed via email, it should be stored in an intranet structure. Web technology was not used at the studied academic research laboratory. At the time of the MainframePC survey and the Jonrad study it was used only externally[1] in these organisations. Although tools for handling email often include Web interfaces, it is not possible to draw far-reaching conclusions from these studies. However, during the second round of interviews in the longitudinal case study at MainframePC, employees had access to the World Wide Web and there also existed a Web-based intranet, and this created problems similar to the problems with several email systems. The Web became another source of information, besides the mainframe-based intranet. Although the Web-based information had graphical and layout possibilities that the old system lacked, respondents mentioned that the Web-based intranet created problems with knowing where to search for information and double information. Some information was published only in one of the systems, while other information was published in both. When a respondent could not find information in one of the systems, he had to search in the other as well, and there he had to browse through information that he had already seen in the first system.

The transfer of information from the real world in the form of papers and books to the virtual world of email, databases, and Web structures may have made it more difficult for co-workers to realise that a person is inundated with information. The visual feedback that piles of paper on the desk or in the paper mail box give is totally missing for these virtual sources of information. In order to handle the virtual overload we must find ways to make others aware of the information overload. This feedback could be provided by, for example, a grey-scale[2] in the email address: When an address in an email message is filled in, the address to overloaded recipients could be greyed out.

1. The company and the organisation had a Web site, but employees normally did not have access to the Web.
2. This would not consume screen space. Colour is another possibility, but Tufte (1983. p 154 & p 183) argues against colour use for such purposes with good reasons.

Technically, this feedback is fairly straight-forward within an organisation[1], if the users could provide the system with information regarding their overflow status. As several studies have shown, it is not possible to draw conclusions on overload from email flow and inbox sizes only (e.g. Hiltz and Turoff 1985, Mackay 1988, Lantz 1996, and the study of the academic research laboratory in chapter 3). The limit for overflow seems to be individual, and possibly also changing with time. More research is needed to define which information that would be interesting for senders to know. One possibility is the frequency of which the receiver has read email in e.g. the last week.

Lansdale (1988) suggested that more cues to identify and remember messages simplifies recall and recognition of documents. For email messages, colour could be used as one way to personalise outgoing email messages, in similar ways as personal stationary. This will also influence the search functionality in email systems that should support search queries for different colours of the message and also position of logotypes and other pictures in messages. However, colourblindness must be taken into consideration.

7.3.2 Communication overflow

Communication overflow, defined as people's undesire to handle communication and caused by the sender, message, or the context (Ljungberg 1996, see also section 2.5.5 in this thesis) was not considered as a large problem for the respondents in the longitudinal studies. The respondents in the MainframePC study had rarely noted any communication overflow. The managers in the Jonrad study did mention communication overflow, but not as a problem. Their communication overflow consisted to a large extent of employees that wanted to discuss issues with them, and these managers considered this, handling employees and the employees' concerns, as their main work task.

Although all managers claimed that they did not consider the communication overflow that their employees caused as something problematic, they all worked during evenings, mornings, and weekends in order to avoid interruptions by their employees. One manager had started to question the many meetings that she was summoned to and tried to avoid some of these meetings when it was possible.

Dividing their time into visiting hours and non-visiting hours would not solve the problem for these managers. There are several reasons for this: it requires that all or most employees heed these hours to be effective, employees must anyhow have a possibility to interrupt when emergencies occur, this division in time might separate the manager from the employees. Several of the managers in the Jonrad study tried to minimise such separation. Further, the strict schedule that these employees followed each day limited the possibilities to visit the manager severely – another constraint on the time could make all face-to-face meetings with their manager impossible.

Communication overflow is not only a problem for the person that is inundated, it is

1. If messages are sent between organisations it is technically more difficult to know the current overflow status of the receiver at the time of writing a message. This could be partially solved by e.g. using answer frequency to previously sent messages.

also a problem for those that need to communicate with this person, but cannot find time to do that. One of the respondents in the MainframePC study described how the communication overflow that the help personnel had was handled by using personal relations to circumvent the official way to get help.

The courtesies and social talk that occur in phone conversations can be regarded as a form of communication overflow. Two of the respondents in the MainframePC study avoided to use the phone for this reason in order to save time and used email instead.

Communication overflow is two-directional. If managers would use strict visiting hours or say to employees that they will get back to them later they would get another problem: a cognitive stress of remembering to actually contact this person or worrying about the issues a person wants to talk about. In many cases it can be better to take the cost of the interruption and handle the problem immediately instead of adding tasks to the mental to-do list.

The many interruptions that managers have also makes email a suitable communication tool. If the manager is reading or writing an email message when a person enters a manager's room, it is much easier to interrupt that, and later come back to that issue, instead of interrupting a conversation in person or by phone.

The same awareness mechanism with a grey-scale that is described above for information overflow is also applicable for communication overflow. Ideally the status used in the email system would be visible in the real world as well, e.g. by a sign on the door.

7.3.3 Real life cues for communication overflow

Few, if any, organisations consider cleaning of their employees' rooms as something that the employee should take care of him/herself. Normally organisations have staff employed to empty waste baskets, clean windows and floors. However, no organisation known to me, encourages their employees to use company time to organise their personal email messages and computer files, although the possibilities to find some of these messages fast is important for the organisation's efficiency.

In the MainframePC study, several of the respondents in the survey wrote comments to the question about their cleaning habits that they did not have time to do clean-ups. Lantz (1996) reports that handling personal information, such as email, was not considered as "real" work by the studied company. This may indicate that handling of personal information has to be done during spare time, which may be impossible for employees with demanding work and a social life outside the workplace.

The lack of time to handle electronic personal information might be understandable as no manager ever sees the mess in other peoples' mailboxes and file systems. However, we can compare a person overloaded with paper mail with a person overloaded with email messages. Anyone that walks by a room filled with large volumes of paper mail can see the need for more space and maybe even an assistant to the person handling the paper mail, or to reduce the amount of work tasks. For example a project leader that is inundated with paper mail may be assigned a secretary to handle this.

When this information is transferred to the email system, or any other computer mediated information system, overloaded people may be difficult to identify in other

ways than the fact that occasionally, email messages sent to them are not answered at all.

A sustainable information policy in an organisation must handle this problem and the systems used must give support to identify overloaded people.

7.4 Organisation of email messages

Many users store email messages in order to use the messages as an information source in the future. In the MainframePC study two-thirds of the respondents used email to store information. An increasing number of stored messages increases the problems with overview of the messages and finding a certain message manually becomes more difficult. The organisation of email messages was the single most important observed source of problems in the study of the academic research laboratory. Even those that perceived themselves as good organisers in the real world could not transmit this knowledge to the computer.

Among the respondents in the MainframePC study there was a correlation between the number of stored messages and the access frequency of these messages: those that had many messages stored also had a high access frequency to these messages. Apparently these messages were not stored in vain, but was it necessary to store *all* these messages? A fourth of the respondents had more than one thousand messages stored. The two respondents in the longitudinal study at MainframePC that stored email messages both claimed that only a few of their stored messages were of any use to them.

Disadvantages of storing too many messages that the respondents mention are problems with overview and disk space. Problems with overview may cause important messages to disappear among the numerous other messages. Disk space shortage problems might increase in the future. Although memory is becoming increasingly larger and cheaper, the multi-media possibilities in email may cause a few messages with sound or video clips to fill up all available disk space.

These multi-media messages also take time to handle. For a person reading email via a high speed 56 kbaud modem, it will take more than a minute to transfer *one* 0.5 MB message. If this message is stored in the inbox it will take more than a minute to transfer the inbox, regardless if the message should be read or not. This problem could be diminished by functionality in the mail tool to remove the attachments from email messages. With the attachment stored in another place than the email message, the size of the messages would be reduced dramatically, and with a proper handling of the remaining link in the message to the attachment it would still be possible to access the attachment from the email message.

This section is divided into three parts: a characterization of different strategies for email organisation, a description of the evolution of users, and design suggestions to improve the possibilities for email users to organise their messages.

7.4.1 Strategies for organising email messages

The choices a user has between different strategies for organising email messages is a balance between different advantages and disadvantages. The advantages of different strategies for storing email messages, folder usage, and cleaning habits are displayed in tables 7.4 to 7.6.

Table 7.4 Advantages of different strategies for storing incoming email messages.

All/many messages stored	Few messages stored	No messages stored
• Complete documentation available. • Decisions to delete messages simple (no/few).	• Better overview of messages. • Less disk space needed. • Possible to use email as a to-do list.	• Decision to delete messages simple (all). • Less disk space needed.

The strategies for storing incoming email messages described in table 7.4 are only examples. Users may have any strategy between saving all messages and deleting all. In the MainframePC survey 23% of the respondents used the strategy to store all incoming messages, and 5% deleted most or all incoming messages. The vast majority of respondents used a strategy in-between these two and stored some messages and deleted the rest.

Although none of the interviewed respondents used the strategy to store all incoming messages, it is possible to identify some advantages for this strategy. When all messages are stored the user knows that no messages are deleted by mistake. This provides the user with possibilities to search for any message, especially if the search facilities in the email tool are adequate. Also, these users never have to make decisions of which messages to delete.

The main advantage of storing only selected messages is a better overview of the remaining messages. This overview increase the possibilities to use the inbox as a to-do list. Respondents in all three studies also described that they felt uncomfortable when the number of messages stored was higher than the number of messages visible on the screen. In some cases two screenfuls could be accepted, but then they felt out of control of their email.

The strategy to delete all messages was rare. Only one interviewed respondent (in the longitudinal case study at MainframePC) used this strategy. His main reason for this was that he did not consider email messages valuable and minimised his time to handle email.

Table 7.5 Advantages of different strategies for folder usage.

Many folders	Few/no folders
• Better overview of projects/work tasks. • If many messages stored: faster to find messages manually.	• Saves time at storing (few or no choices between folders). • Better overview of folders.

The advantages of two different folder usage strategies are described in table 7.5. Those that used folders in the longitudinal case studies motivated their usage of folders with the possibility to maintain an overview of the messages in their inbox, while still storing a larger number of messages with important information. This simplified searches of messages both in the inbox and in folders, especially when they were searching for a message that they knew was in a certain folder, but could not remember the subject line exactly. One of the respondents also claimed that folders facilitated deleting messages: when a project was concluded he could delete all related messages by deleting their folder. In the MainframePC survey on average 10% (for those that had few folders) to 25% (for those that had many folders) were categorised as "unused" by the respondents. These folders could probably be deleted if there was time to clean up the email.

The advantage of not using folders at all, or only a few folders, is that archiving becomes simple – as there are no or few choices on where to store messages. Those that store all their messages in the inbox do not have to make any choices at all. The choice to not use folders is not always made voluntarily. Many of the respondents in the academic research laboratory and at MainframePC complained about old interfaces that complicated folder usage. In the Jonrad study the respondents wanted to use more folders (besides the standard folder that came with their installation), but failed to create new folders, or to move messages to them.

Table 7.6 Advantages of different strategies for cleaning email messages.

Clean often	Clean seldom/never
• Overview of remaining messages better. • Time saving when many messages can be deleted without reading them a second time because the user can remember the content of the message by reading the subject line.	• Time saving when messages do not have to be read just in order to delete them and frequent cleaning sessions result in reading many messages several times.

The advantages of two strategies for cleaning messages are displayed in table 7.6. The respondents in the longitudinal case studies and in the study of the academic research laboratory that cleaned often described two reasons for this:

1. Maintaining the to-do list by deleting messages as soon as the task was handled.
2. Deleting messages after reading or handling them was considered as efficient compared to reading these messages again during a cleaning session when they might have forgotten what they were about.

Several of the respondents reported that their email messages in general were deleted at one of three different occasions: directly after reading it the first time, during browsing and searching for other messages when they noticed that a message was a thing of the past, and finally during cleaning sessions.

The interviewed respondents that did not clean among their messages mentioned lack of time as the main reason (this reason is also mentioned in comments to the MainframePC survey). A regular cleaning session would require reading many of the

old messages again since the contents of them are forgotten. One respondent used to archive and delete messages, but a longer absence from the email system created chaos in the inbox and after that she never managed to restore the order.

The strategies of storing and deleting messages and folder usage are not totally independent of each other. For example, an email user who has few or no messages stored has no use for folders. Whittaker and Sidner (1996) used folder usage and cleaning habits in order to group their users into three different categories: Frequent filer, Spring cleaner, and No filer, see table 7.7. In the MainframePC study a fourth category could be identified: those that used few or no folders and cleaned often. Whittaker & Sidner had no such users in their study.

The choice of strategy for organisation of email messages is affected by the tool and by the number of incoming messages. No support could be found in the MainframePC study for connections between filing strategy and work task. Neither was any support found for a relation between strategy and work position, which confirms findings by Whittaker & Sidner. Other statistical significant results in line with their study are:

- Managers received more messages than others (t-test P-value 0.0026).
- The number of failed folders (here defined as folders not in use, Whittaker & Sidner defined them as folders with fewer than 3 items) was correlated with the total number of folders ($r_{44} = 0.73$, P-value <0.001). Whittaker & Sidner's explanation for this is that the problems of remembering folder name definitions increases with the number of folders and time.

Also in line with their study, but not statistically significant were the results that Frequent filers had fewer messages per folder and fewer "failed" folders than others, and that Spring cleaners were less likely to be managers and had more failed folders.

The only result in the MainframePC study regarding organisation of email messages that contradicted Whittaker & Sidner was that the Spring cleaners at MainframePC received more messages than others (t-test P-value 0.035). The difference may be explained by diversity of email tools at MainframePC; as the email tool affects the choice of strategy for the users. The different methods used might also have contributed to the difference. Whittaker & Sidner were able to gather quantitative data by taking a "snapshot" of each users mailbox, whereas at MainframePC the users were only asked in a survey how many messages and folders they had. The users at MainframePC that were overloaded with email and other tasks may therefore be under-represented. However, the response rate from managers, who are usually overloaded, were 81%, so the results presented here have at least some validity regarding this aspect.

Folder users in the MainframePC survey were more intense users of email and other electronic communication than no-folders: folder users sent and received more email messages, searched for stored messages more often, and read more electronic bulletin boards regularly. The cleaning habits in the MainframePC study were only related to which tool the user had, no statistical significant correlation could be found with e.g. number of incoming, stored, or sent messages or number of folders. In table 7.7, the four subgroups are displayed together with a typical profile for each user category.

Table 7.7 Strategies and their main causes.

Strategy	Folder usage	Cleaning habits	Typical profile in the MainframePC survey
Frequent filer	Yes	Often	Intense email user. Used Notes.
Spring cleaner	Yes	Occasionally	Relies heavily on email. Used MMM.
Folderless cleaner	No	Often	Limited email usage. Used MMC.
Folderless spring cleaner (No filer)	No	Occasionally/ not at all	Used MMC.

7.4.2 Evolution of users

How do the users, deliberately or un-deliberately, choose a certain strategy to organise their email messages? One hypothesis, consistent with the findings in our studies is that user behaviour evolves with time. An elementary model of the different stages is presented in figure 7.1. An earlier version is presented in Bälter (1997b). A user new to email will probably start without folders, that is to the right in figure 7.1. Whether the user cleans often or occasionally may be a more individual attitude towards organisation of email messages and cleaning. With time the number of incoming and stored messages increases, and a Folderless cleaner may take an active decision to start using folders and transform into a Frequent filer, or give up cleaning and become a Folderless spring cleaner. A Folderless spring cleaner may start to use folders, and become a Spring cleaner. Once the decision is made and folders are created, time must be spent to maintain the folder structure. A Frequent filer overloaded with messages may, due to time shortage, give up the deleting and filing and become a Spring cleaner. These transitions are displayed in figure 7.1.

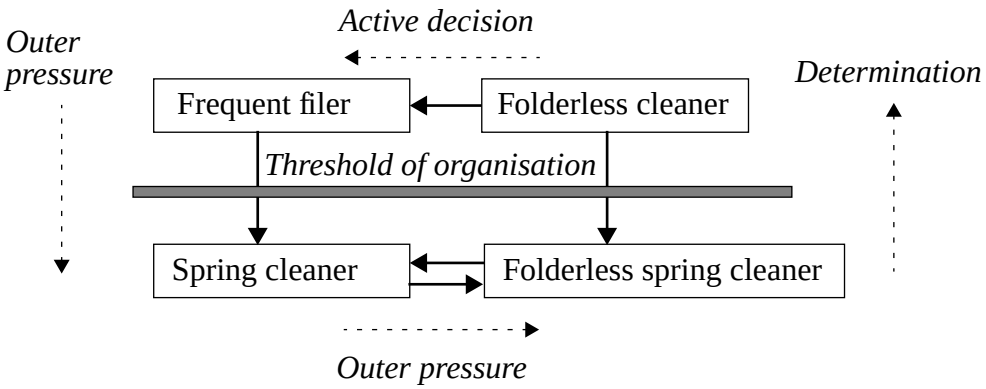


Figure 7.1 Simple model of expected main transition of users and forces for changes. The four framed states represent a categorisation of users after their folder usage and cleaning habits (see table 7.7). The filled arrows represent transitions of users from one state to another. The dotted arrows represent common decisions and outer pressure that can make users change states. The outer pressure consists of time constraints (other work tasks, absence from the email system) and the incoming flow of messages. The thick threshold line represents a (partial) breakdown in the users' filing strategy. Once they pass below it, the difficulties to get back may be overwhelming.

The outer pressure that pushes users down and right in figure 7.1 consists of other tasks that limit the available time for handling email messages, but also of the stream of incoming messages. A large number of messages makes organisation of messages time consuming. This outer pressure may be influenced by giving the users time to handle their email and reducing the number of email messages.

The necessity of time available to maintain the order among the email messages is reported by the respondents both in the MainframePC study and in Whittaker & Sidner (1996). The respondents' descriptions in interviews and the survey suggest that there is a threshold in the level of organisation that users pass. Once beyond this threshold, it is almost impossible for the users to turn back. Movements up in figure 7.1 may be driven by persistent determination to clean the inbox and/or folders frequently, in combination with available time to do this.

There are certain data that suggest that the evolution of a user proceeds mainly counter clockwise in figure 7.1. The number of email users is increasing and with it the number of email messages. The respondents in the MainframePC study that used email the most were also folder users (to the left in figure 7.1). Therefore it is important to help folder users with their specific problems.

In Whittaker & Sidner (1996) the group named "No filers" had given up the efforts to keep an order of their email messages. Their No filers had the same cleaning and folder usage strategy as the Folderless spring cleaners in this study, but the No filers received more messages (average 58 messages a day compared to 10 for the Folderless spring cleaners in the MainframePC study). The difference between these two groups indicates that the model illustrated in figure 7.1 should be extended. The No filers could be a state for the email users who have given up archiving, who do not have time to archive and delete old messages. In the MainframePC study this "clean seldom, use no folders"-category is also filled with MMC users that did not use folders due to the interface, which may explain the lower average number of messages.

The case study at MainframePC and the Jonrad study also supports this hypothesis of a counter-clockwise evolution. Two of the subjects had changed strategies during the longitudinal case studies in the described direction. None had changed in the opposite direction within the same mail system. These changes are illustrated as arrows in figure 7.2 with the respondents represented as dots.

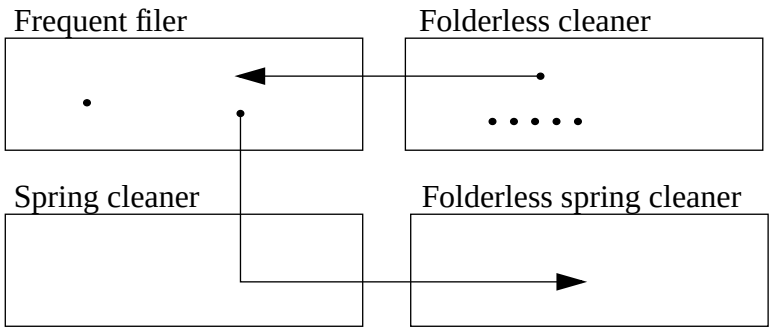


Figure 7.2 Strategy changes during the longitudinal case studies. The dots represent respondents in the two longitudinal case studies. The arrows represent observed transitions of users between the different strategies.

The strategies described above can be refined further. For example some users store all their messages in a folder per month (e.g. the mail system Pine has special functionality to do this for sent mail) which means that they normally do not use folders at all, but still limit the number of messages in their inbox and store all messages at the same time. However, no such users participated in interviews and these users may also be rare: only two respondents in the MainframePC survey used this strategy.

The identification of different strategies used for organising email messages is important to understand the evolution of email users from novices to experienced users. In the Jonrad study the users' inabilities to create folders affected their organisation of messages; they did not use folders although they wanted to because they could not figure out how to move messages to the new folders. The tools had in the MainframePC study a strong influence on the strategy for organisation of messages; one of the mainframe-based email systems counteracted folder usage, the other may have simplified storing of messages in inbox by displaying messages with the most recent on top of the older messages in the message list. The amount of users that have previous experience, and therefore habits, from other mail tools will increase in the future. The tools must therefore provide support for several strategies, e.g. folder usage, no folder usage, frequent cleaning, and spring cleaning.

7.4.3 A simple model of organisation of email messages

In chapter 6 a simple model of organisation of email messages based on key-stroke analysis was presented. The model has yet to be verified empirically, but if the model is valid the following conclusions can be made for users with "normal" values on the involved variables and constants:

- no folders is an efficient strategy as long as the number of messages is less than a few hundred,
- zero to three folders are less efficient than four to approximately twenty folders for manual search,
- the strategy to use many folders (approximately 30 or more) is not efficient according to the model, regardless of the values of the variables and constants,
- for many users, the time differences between the different possible strategies are insignificant,
- the gain in time a reduced number of stored messages give is less than a few minutes a day for many users (i.e it is inefficient to do clean-ups),
- a folder dependent search tool is more efficient than a folder independent one.

The implications that the most efficient strategy for many users would be to use no folders raises demands on the search tools that must be as easy to access as the folders. Tailorable search conditions accessible from a menu could reduce the time to search messages dramatically.

7.5 Novice versus experienced users' needs

There are people that use email as their first choice for almost any type of communication and people that use it only if everything else fails. The longitudinal case studies give several examples: users that store almost everything, only the most essential messages, or no messages at all. In this section the special needs and problems of the novice and experienced users are described. A short sub-section describes complications in studying users when they have adapted their behaviour to their computer tools.

7.5.1 Novice users

The novice email users in the Jonrad study (five managers) were pleased with the functionality of email but they complained about their lack of knowledge of computers in general and especially email. They knew that there existed certain functions in their systems that would be of value for them, but they did not know how to use them, and could not spare the time to learn these functions. Folder usage and sending attachments are two examples of such functions.

These two functions were a part of the basic training course for all Lotus Notes users in the Jonrad organisation. The Notes interface made it quite straightforward to open incoming attachments and this was no problem for these users. However, for some users it was still much easier to use the fax to send documents compared to sending attachments. This had the result that the function to send attachments was never trained and thereby forgotten.

Also, when these users returned to their work sites after the course, they had no need of folders since they had too few messages. When they six to ten months after the basic training course had the need for folders, the knowledge of how to create them was forgotten. Only one of the five managers succeeded in using the functionality for handling folders when the need arose.

On the Origin of Users by Means of Natural Selection

The capacity of computers and computer applications has evolved rapidly during the last decades while the capacity of the users still remains approximately the same. While the usability of the interfaces has improved with windows, menus, buttons, and direct manipulation; their adaptability to the user is in many cases still on an elementary level and fails to acknowledge the development of the user from a novice to an experienced user.

The complex impression a system with many and long menus can make, especially on beginners, may of course be reduced with short or quick menus that already exist in many applications today. However, there is a problem with these short menus: when the user cannot find a function, is the cause that the function does not exist, is not visible, or that it has some other name than the expected one? Ideally, the application itself should be aware of which functions a user has a need for and which functions that could be hidden from the interface, until that day when the need exists, such as the experimental adaptive interfaces by Trumbly, Arnett & Martin (1993) and Trumbly, Arnett & Johnson (1994). Their experiments illustrate the importance to support the dynamics of the users' working situation and the evolution of users. The occurrence of

discretionary users described by Santhanam & Wiedenbeck (1993) that have a novice-like behaviour when it comes to tasks outside their routines implies that more support for these users to evolve with their computer tools would increase both their knowledge and performance (cf. section 2.3 in this thesis).

For email systems the folder functionality is superfluous until the day when the number of stored messages exceeds one or two full screens. At least this is what the respondents in these three studies mention as a limit for controlling their messages. Ideally the tool would then describe to the user how, and why, to use folders. More research is needed to identify other functions that could be introduced after a time of usage. After all, computers and the science behind them are intended to support the users, not force them to adapt to the computers.

7.5.2 Experienced users

Although the MainframePC study was intended to be a pre-study of the company before the introduction of Notes, Notes was already the most common email system. 77% of the respondents had access to Notes, compared to the 10-20% that the company expected. The studied company had consequently come a long way of the transition from the old mainframe email systems, and the mentioned disadvantages with Notes were derived from hands-on experience, not speculations.

Notes was popular among its users, but 21% of those that had access to Notes did not use it according to the survey, despite the fact that Notes access was voluntary and they had to ask for Notes access to get it. The group with people that had access to Notes, but did not use it still remained during the latest visit to the company 18 months after the survey. This was a problem because senders of messages never knew which system the addressees read messages in, and therefore had to send the same message in two or all three systems, which of course contributed to duplicate information and extra work. The strength of the old infrastructure was in this case actually a hindrance for the introduction of the new communication system.

Half of the respondents in the MainframePC survey that had access to Notes, but did not use it were managers, half were mainframe system developers. Many in these groups were reluctant to use Notes because they had little use of it in their current work, or no time to learn Notes. Many of the advantages of Notes were no advantages for those that mastered their old email system. No-one complained directly about Notes (besides that it takes time to learn). The complaints were related to the hardware, the LAN, the bridges to other systems, and the fact that the possibility to read email at other offices was not supported.

In a large company there will always be a group that does not benefit from a new system, because their main work tasks will not be simplified. This simplification of work tasks has been described by Grudin (1988) as an important factor for a successful installation of a groupware system. In this case the group of people working with mainframe systems will continue with that for years to come, and have little use of the new Notes system. It is important to identify these groups to understand their communicative situation, work tasks, and demands, before the installation of a costly groupware system. Users may demand at least two things from a system that should replace

another system:

1. Everything essential that was possible to do in the old system, must be possible to do just as effortless in the new system.
2. Something essential must be more effortless or entertaining in the new system.

The superiority of graphical interfaces over command based ones to reduce the mental efforts to interact with the system is probably unchallenged when performing new tasks (cf. Preece, Rogers, Sharp, Benyon, Holland & Carey 1994), due to e.g. the possibilities to explore the interface for commands. But this study of real users in their real working environment shows that it is questionable whether 20 years of experience can be balanced by a new graphical interface without a long learning period. A quote illustrates the attitude towards PCs from a mainframe programmer:

> I am aware that I will not be able to avoid using the PC, but PCs are unstable and slow. The only disadvantage of mainframes is the limit of two windows. I am not particularly interested in using a mouse, it only makes my shoulder ache. I could learn to use a PC, I am not threatened by it, but I only use it for file transferring between the PC and the mainframe. I can understand why everybody is shifting to PCs, as a software producer there is much more money to make on PCs.

Another example is an event that occurred during an interview with a mainframe developer. He had worked for 35 years in the company and described enthusiastically how easy it was to use the mainframe. "There are not that many commands to remember, 200 perhaps, and there are approximately 5000 programs to use on the mainframe," Then he gave a demonstration of how easy it was to swap between different accounts and databases. Although I tried to concentrate on identifying the command names as he wrote them, I did not stand a chance to read them. Everything passed in front of my eyes at a breathtaking speed, with no pauses for thoughts and few corrections of typing errors. The example illustrates that complex commands are not perceived as a hindrance for a person that already knows them. This may be related to the concept of *directness*, as described by Hutchins, Hollan & Norman (1986).

7.5.3 Adaptation to the email tool

The respondents in the academic research laboratory described in chapter 3 showed a great capacity for adapting themselves to their email tool. Some users found other programs to use for searching among the messages when the search functionality in the email tool was inadequate. Other users simply gave up and avoided problems by not using certain functions or even avoided using email in certain situations. For example they used only one folder, even though they wanted to have several folders, if it was difficult to get an overview of folders or to move messages between the folders. They also avoided reading email from home because the email formats of the email tool at work and at home were incompatible. This adaptation concerns all users: even computer scientists demonstrated that they did not understand the manual or the on-line help.

Users learn inconsistencies in their email tools and adapt their management of email to the inconsistencies; e.g. avoiding using the "close" button in some windows because it will close the application, instead of just that window.

This adaptation makes it difficult to identify users' problems through surveys. Even in interviews a researcher many times has to read between the lines in order to detect user problems among their work-arounds. The exaggeratedly humble users that adapt themselves to any computer application design complicate the possibilities to design systems with a high usability, even with user participation.

7.6 Design suggestions

This section describes design suggestions that would diminish some of the problems described in the previous sections in this chapter. It is divided into six sub-sections: folder usage, sorting email messages into folders, reducing the amount of stored messages, tailoring the email system to the user's work habits, co-existing email systems, and support for national characters. The last section is a summary of design suggestions presented in previous sections of this chapter.

7.6.1 Folder usage

In order to support folder users, it would be an improvement to have the possibility to store a message in several folders, as messages that fit in several folders were the most frequent problem for folder users in the MainframePC study. There are already similar solutions for file systems (alias, short-cut, link), i.e. there exists only one message, but this message is visible in several folders. A similar suggestion has been made by Palme (1995c).

A respondent reported that sometimes more than one folder is created for the same purpose. This is one cause of the "failed" folders, described by Whittaker & Sidner (1996) as folders with few messages. If the first folder is forgotten with a few messages in it and another created, the user will not be able to find all related messages in either folder. A warning for creating new folders with names that are similar to old folder names could diminish this problem, especially if the system was aware of synonyms as well. The functionality is similar to the spelling checkers in word processors.

The possibilities to identify failed folders could also be improved in order to help the users to maintain order among their messages. One way to identify these folders is to identify folders with few messages, another is to keep track of which messages are opened and identify folders with messages that have not been opened for a long period of time. This could be used both to delete folders that no longer are useful and to identify mis-categorised messages.

7.6.2 Sorting email messages into folders

The problems of finding the correct folder for a message could be supported by clustering (see e.g. Söderberg 1995), where a distance between messages in a multi-dimensional space, with each content word[1] as a dimension, is used to define messages as "closely related" to each other. For example messages containing the word "Internet" are considered more closely related to each other than messages that do not con-

1. Words such as "a", "the", "and", "also", "but", "maybe" are ignored.

tain that word. Messages that contain both the words “Internet” and “email” are considered more closely related to each other than messages that only contain the word “Internet”. New messages are then sorted into the same folder as the most closely related message(s).

A slightly more straightforward way is to allow the user to characterise each folder with some keywords. When a new message arrives, the email tool could suggest a few folders for the message, based on these keywords or clustering. This additional support for folder archiving increases the possibilities to handle a part of the archiving semi-automatically or with a filtering system that learns from experience. The keywords added to a newly created folder will in both cases provide the mail tool with more cues to sort messages into the new folder. Otherwise this folder will initially be empty and messages have to be manually moved to it to provide cues for the sorting filter.

If the tool only suggests the folder instead of automatically placing the message in a folder, the user would still be in control and have the possibility to accept or override suggestions from the email tool.

Outgoing messages were stored by 95% of the respondents. A majority stored outgoing messages in a separate folder, but almost half of the respondents stored them in the same folders as incoming messages. The reasons behind these strategies were not investigated, but possible explanations are that messages are stored in a separate folder to reduce the number of messages in other folders, and to simplify retrieval as the sender knows where to search for sent messages. A reason to store messages together with incoming messages is to have all messages about a topic stored together to facilitate searches about that topic. Automatic storage of outgoing messages in a separate folder is possible in many mail tools today, as well as search tools that allow the user to search among all outgoing messages, regardless of the folder they are placed in, but the user could be given more support to store outgoing messages together with incoming messages. The folder keyword method described above is one way, perhaps in combination with the dialogue history. If previous messages in a dialogue are stored in one folder, the probability is high that a reply to the latest message in this dialogue should be stored in the same folder as well.

7.6.3 Reducing the amount of stored messages

For Spring cleaners, more support for deleting messages might be useful. Some users do not want to delete messages because they might delete the wrong message, or might regret the decision to delete later. In some email tools these deleted messages are moved to a waste-basket and the user can un-delete these during the same session. However, when the session is concluded these messages are permanently deleted. If these messages were stored in the waste basket for a longer period of time, as for example in Netscape Messenger, the user would be assured that the messages will be possible to un-delete in the future, and not only during the current session. In systems that automatically backup files, this would give enough time to store the messages in the backup system and thereby allow the user to un-delete a message even after several years. The messages could then automatically be removed from the waste-basket after a user specific time, e.g. a week or a month. When asked in the MainframePC study, a

third of the respondents were positive or very positive to such a functionality. Palme (1995c) suggested automatic deletion by user defined rules for all folders.

In a system that keeps a record of when a message is opened, it becomes possible to delete e.g. all messages not opened for a certain period of time, e.g. two years. These messages could be listed separately first in order to give the user complete control over messages that should be deleted. The user should also have possibilities to define exceptions for this automatic deletion for individual messages and folders.

An adequate interface to an electronic address book reduces the need for storing messages simply in order to save the address. Besides picking the sender's address and name from a single message upon request, which is possible in several email tools today (for example Netscape Messenger and Pine), a scan function that extracts this information from *all* stored messages simplifies the creation of a personal address book, especially when the user has changed email system and old messages are possible to transfer to the new system.

Acknowledgement of reception were popular among the users both in the MainframePC and the Jonrad study. The design of this feature differed between the Notes system, where actual messages were returned to the sender of a message to confirm delivery, and the MMC system where the status of all recipients of a message were possible to overview at the same time by viewing the status of the sent message. Several respondents in the MainframePC study complained about this lack of feedback in Notes and even gave this as one reason why they did not want to switch from MMC to Notes. The MMC solution seems to be a better design for the users.

7.6.4 Tailoring the email system to the user's work habits

The user must have control over flags that mark e.g. read/unread messages. In some tools, messages are marked as read as soon as they are opened, which often is the best choice, but it is impossible to change the status back to unread when a message is opened by mistake, or it is too long to be read at the time of the first opening. That is the tool has control over the user.

Barreau & Nardi (1995) suggested that the information in a user's file system can be divided into ephemeral, working, and archived. This is highly applicable for email, e.g. messages can be ephemeral (e.g. an invitation to a meeting the same day) or working (a message asking for information that the receiver has to search for). One solution to handle these different types of messages could be to provide the tools with possibilities to organise them spatially (which is possible for files in many file systems with a graphical interface). The one-dimensional list of messages in each folder is the only one available today for email messages, but according to Mander, Salomon & Wong (1993) users prefer to group items spatially and in piles.

Some ephemeral email messages could be provided with a "use before" date, to simplify deleting. When the time for e.g. the meeting or the service is over, these messages are of no interest for many users and could be deleted automatically. There could be a short default "use before" date for email messages that the senders of messages could change. This would provide the sender with a benefit (the message would be kept longer by the receiver) for his/her work (changing the default time). This cost-

benefit relation was found important by Grudin (1988, see also section 2.4.3 in this thesis) in order to make people want to use a system. The receiver should of course have the same possibilities to mark messages when they are read for automatic deletion after a certain date.

For some users the email tool is the primary information source, for other users the file system is. Email tools should therefore support drag-and-drop both within the email tool and between the email tool and the file system. This would make it possible for users to chose *one* system to store all information in.

Modern graphical interfaces may have advantages over old text-based ones, but sometimes the attempts to protect the user from making mistakes go too far. In many graphical email tools (for example Lotus Notes, Eudora, Microsoft Internet Mail, and Netscape Messenger), incoming email messages are write-protected. When an email message is received that, at least according to the receiver, should have another subject or needs to be commented and this write-protection prevents the receiver from e.g. giving the message a proper subject and thereby the system increases the difficulties of retrieving messages.

However, possibilities to change incoming messages also raise a question of feedback. Should it be possible to see which parts of a message that are from the sender and which are added afterwards as it is possible in paper messages? This feedback could be handled in the same way as it is in word processing applications such as FrameMaker and Word: colour coding and/or underlining could be used to mark inserted and deleted text if this is needed.

Since so many users view their stored email messages as an information database, they would have use for functionality such as copying a message in order to edit it for storage purposes. Today, users have to forward messages to themselves in order to edit incoming messages. For example if a message arrives that, according to the receiver, regards two or more subjects, the message could be copied and edited in order to fit the information structure that the receiver has built.

7.6.5 Co-existing email systems

The Notes system installed at MainframePC was unable to communicate with the older mainframe-based systems: messages could not be sent in a simple way between the systems. Another incompatibility was mentioned in the study of the academic research laboratory, where old messages could not be transferred to new mail systems in a simple way.

Users with thousands of messages stored may be reluctant to switch to a new email system if the messages in the old system cannot be transferred to the new system. This may explain the large usage of old email tools at the university in the study of the academic research laboratory in chapter 3, where a large number of messages were stored.

Modern word processors can often read files from other word processors, even from other platforms. In order to put the user in control, this should be possible for email tools as well, and the email tool should preferably be possible to run on all platforms (at least Macintosh, PC, and Unix) to support the different work styles and work sites. The Messages system described in section 2.2.7 is an example of a system with multi-

platform support and possibilities to import email messages from other mail systems.

The old command-based mainframe systems were once the peak of computer technology, but today many refer to them as “dinosaurs” and demand that they should be replaced with modern systems. However, the development of computer mediated communication systems is unlikely to cease today. This suggests that the systems that are installed today will be replaced with something totally different in ten years. Those that introduce a computer mediated communication system today should therefore plan for the replacement of that system in the future, and systems should be designed to co-exist and share data with other systems.

7.6.6 National characters

The mainframe based email systems in the MainframePC study could not handle national characters such as å, ä, and ö (see description on page 22). Within an organisation these problems can be avoided when all users have only one computer type and the same email tool. However, limiting people to certain tools may reduce the technical problems but increase other problems, such as that users may feel out of control in the choice of one of the most important tools they use. Also, today the email communication between companies and organisations is increasing rapidly which make the solution with one system practically impossible.

Although international standards can be used to solve this problem, this is not enough. For several years email will still be sent, transmitted, and received via computers and programs that do not follow these standards. The email tools should therefore provide possibilities to convert distorted characters to their original shape, at least handle the most common distortions.

7.6.7 Summary of design suggestions in previous sections

This sub-section summarises design suggestions made in this chapter in sections previous to 7.6 in order to have all suggestions in one place.

- Warn senders when receivers have not read their message for some time (see section 7.1.1). This would give the sender information that is needed to take some action to e.g. search this person or find the information somewhere else.
- Use interrupting notifications (visual or audio) of incoming messages only when important messages arrive (see section 7.2.3). The audio and visual signals that are used today often interrupt other tasks for the users and many users have difficulties ignoring these signals.
- Improve precision in distribution of information with a database containing each user’s interests to facilitate construction of distribution lists for a single message (see section 7.3.1). This would reduce the number of uninteresting messages for overwhelmed users.
- Delete, or re-route, advertisements and chain messages already at the email server (see section 7.3.1). This would also reduce the number of uninteresting messages.
- Default answers to handle large number of messages about the same topic (see section 7.3.1). This would simplify email handling for users that receive many messages about the same topic.

- Improved feedback and a warning for “reply-to-all” messages sent to a large number of recipients (see section 7.3.1). This would also reduce the number of uninteresting email messages, furthermore avoid embarrassing moments for senders that reply to all by mistake.
- Feedback to other users providing awareness of a person’s work, information, and communication overflow (see section 7.3.1 and 7.3.2). This could create an understanding for late or absent answers to email messages.
- Possibilities to personalise outgoing email messages, e.g. by colour (see section 7.3.1). This would make email messages more similar to stationary and increase possibilities for remembering messages and also search function as cues if the search tools also are adapted to this.
- Functionality to remove all attachments from all email messages (see section 7.4). For email users that receive large attachments this could reduce the size of mail folders significantly and thereby simplify email usage via modem.
- With adaptive systems, interfaces could be designed to not overwhelm new users initially and then change with the users’ evolution by introducing concepts such as folders when there is a need for them (see section 7.5.1).

7.6.8 Design implications for other computer-based information

The ideas described in this section to facilitate organisation of email messages can in many cases be applied to other areas of computer-based organisation of information. Two examples are bookmarks in Web browsers and files in the ordinary file system. Both have similar properties as email messages: they are numerous which make overview difficult, they are possible to organise in folders (directories, catalogues), and their value changes with time – in many cases it decreases with time.

Aliases to files already exists, but not in bookmarks, and the usage of bookmark aliases may be limited as long as the user does not add personal comments to bookmarks.

A warning for creating new folders with names that are similar to old folder names could be useful both in the file system and when organising bookmarks.

The problems of finding the correct folder for a bookmark automatically is even more difficult than the corresponding function for email messages. The bookmark itself (the link to the Web page) does not contain very much useful information and the Web page itself with all links may contain too much information. For ordinary files the situation is complicated by the many different file formats used by e.g. different word processors that make content analysis difficult from a programmer’s point of view.

Waste baskets already exist in file systems, but not in bookmark handlers and there they could support the user to remove bookmarks without actually deleting them. The functionality can be simulated by manually adding a folder named “Waste basket” (as it can be done in email systems) but the functionality that automatically removes items that have been placed in the waste basket after a certain period of time does not exist in any of these three systems.

The functionality that keeps a record of when a message/file is opened or a bookmark is used could be useful in both file systems and bookmark handlers in order to support the user to remove items that are not used for a long period of time.

Spatial organisation of files is possible today (although some file systems limit

these possibilities) and Mander, Salomon & Wong's (1993) conclusion that users prefer to group items spatially and in piles, implies that the one-dimensional list of bookmarks could be extended to two dimensions.

These suggestions all need more research to understand the users situation. For more design advice on bookmark handling, see Abrams, Baecker & Chignell (1998).

7.7 Final words

Email is one of the most important communication tools at workplaces today, and it might become as important for home usage in the future. However, as these studies show there is still room for improvements of email technology.

The best way to identify users' needs is to study them in their daily work, but the complexity of a working context makes single studies a blunt tool. To understand not only *what* the users are doing, but also *why*; it is necessary to study the same users with several different methods: interviews, surveys, observations, logging of data, and experiments.

In this thesis is a variety of users have been involved, novices and experienced, employees and managers, and users both with and without a technical background. Also, some of these users have not only been studied at a single moment, but attempts have been made to follow their evolution from novice to experienced. This variety has made it possible to make a more holistic view of email usage from an individual perspective: focusing on email usage, but always in relation to other means of communication and work tasks.

Email is still a young medium and the question whether it will continue to grow and how it will change interaction and communication among people is still in the hands of researchers, designers, and most of all: users.

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Appendices

These appendices has been translated from Swedish and re-formatted to fit the pages. Please ignore the sometimes inferior formatting, the quality was much higher in the Swedish originals.

A MainframePC questionnaire

The first appendix is the questionnaire distributed at MainframePC. There were two slightly different versions of this questionnaire, one for each site. At the country side site, question 19 and 20 referred to MMC only, question 26 to MMC and Notes only and in question 34 the name of the main site was written. The main site version referred to MMM and the name of the country side site in the same questions.

Questionnaire to email users

This questionnaire is a part of the E-project and the purpose is to find out how electronic information is handled today at MainframePC. After the planned introduction of Lotus Notes in the whole company, another questionnaire will be distributed in order to investigate differences towards the situation today (this is the reason why we appreciate if you state your name). The questionnaire is also a part of a research project "Communication patterns in computer supported cooperative work" where handling of electronic information is studied from a user perspective. The people performing the study are researchers at the Interaction and Presentation Laboratory (IPLab) at the Royal Institute of Technology.

This questionnaire contains questions about work situation, communication, computer system, electronic mail system, handling of electronic mail, and some miscellaneous questions. Most of the questions are multiple choice and there is often a possibility to give comments in addition to the questions. The time to complete the questionnaire is estimated to 45 minutes.

All answers will be handled confidentially. Individuals will not be possible to identify (not even by MainframePC) from the results.

If you have questions, you are welcome to contact Olle Bälter on phone:
08-790 91 57, 08-82 77 86, or via electronic mail at balter@nada.kth.se

Name:_____
(Your name will be replaced by a code)

Work situation

1. Which part of MainframePC do you work at?

   ❑ Consultants

   ❑ Market A

   ❑ Market B

   ❑ Production

   ❑ Marketing

   ❑ Others (Economy, HR, Management)

2. Describe your main work tasks:

   _____

   _____

   _____

3. What is your position (several alternatives possible for project managers)?

   ❑ Employee
   ❑ Group manager
   ❑ Project manager
   ❑ High rank manager

   Comment:

4. How many planned meetings (where a summon has been distributed in advance) do you participate in, on average, each month?

   I participate in approximately _____ planned meetings per month

   Comment:

5. How much time do these meetings take in total each month?

   Planned meetings take approximately _____ hours per month

   Comment:

6. Give examples of information that you share with others (in e.g. binders and documents):

   _____

   _____

7. How do you do to share information with others (if you are currently using Lotus Notes, please describe the situation before you started using Notes)?

   _____

   _____

   _____

   _____

Communication

8. In which way and how often do you communicate with other people in your work? State how often you use the different alternatives (one check per line). Email is also called notes. A planned meeting refers to meetings where a summon has been sent in advance, unplanned meetings are all other meetings, deliberate as well as coincidental.

	Never	A few times per year	quarter	month	week	Daily
a) Discuss projects						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
b) Receive work tasks						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
c) Order services from others						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
d) Ask for information relevant for your work						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑

	Never	A few times per year	quarter	month	week	Daily
e) Distribute other information						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
f) Discuss sensitive questions (e.g. personnel issues)						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
g) Delegate work tasks (managers only)						
via email	❑	❑	❑	❑	❑	❑
via telephone	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
at unplanned meetings	❑	❑	❑	❑	❑	❑
at planned meetings	❑	❑	❑	❑	❑	❑
h) Distribute minutes						
via email	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑
i) Send documents for consideration						
via email	❑	❑	❑	❑	❑	❑
via letter or fax	❑	❑	❑	❑	❑	❑

Comment:

9. Communication with others is possible in a various number of ways. With whom and how often do you communicate with other people in some way, e.g. via email, letter, fax, telephone, planned or unplanned meetings when you work?

	Never	A few times per year	quarter	month	week	Daily
Colleagues in the group	❑	❑	❑	❑	❑	❑
MainframePC employees outside the group	❑	❑	❑	❑	❑	❑
Customers	❑	❑	❑	❑	❑	❑
My managers	❑	❑	❑	❑	❑	❑
Employees in the mother company	❑	❑	❑	❑	❑	❑
Others: _____	❑	❑	❑	❑	❑	❑

Comment:

10. How many email messages do you send and receive on average per day (a message sent to several recipients count as one)?

    I send approximately _____ email messages per day.

    I receive approximately _____ email messages per day.

    Comment:

11. How long time on average per day do you use for handling (read, write, organise and delete) email messages (do not include the time to take care of the issues in the messages)?

    I use on average _____ minutes per day (or _____ hours per day) to handle my email.

12. How many phone calls do you have per day on average (incoming and outgoing)?

    I have approximately _____ phone calls per day.

13. How many minutes on average per day do you spend on these phone calls?

    I use approximately _____ minutes per day for phone calls

    Comment:

14. How many electronic discussions/bulletin boards do you participate in or read regularly?

    I read approximately _____ electronic discussions/bulletin boards regularly

    Comment:

15. How much time on average per day do you use for electronic discussions/bulletin boards?

    I use on average _____ minutes per day (or _____ hours per day) for electronic discussions/bulletin boards

    Comment:

Computer systems

16. Which operating systems do you use (have access to does not count, several alternatives possible)?

PC	Mainframe
❑ OS/2	❑ VM
❑ Windows 3.X	❑ AIX
❑ Windows 95	❑ AS400
❑ Windows NT	❑ MVS

    ❑ Do not know

    Other: _____

    Comment:

17. Which of these systems do you have access to and use respectively (several alternatives possible)?

MMM	❑ have I access to	❑ do I use.
MMC	❑ have I access to	❑ do I use.
Lotus Notes	❑ have I access to	❑ do I use.

    Comment:

18. For what is the computer used in your work?

_____

_____

_____

_____

19. What are the greatest advantages with MMM/MMC for you?

_____

_____

_____

_____

❑ See no advantages

20. What are the greatest disadvantages with MMM/MMC for you?

_____

_____

_____

_____

❑ See no disadvantages

21. Give a suggestion of something computer related that you would like to have (better) support for, for example a program or a function in a program:

_____

_____

22. How many new computer applications, small and large, have you suggested during the last year (regardless whether they have been implemented or not)?

I have suggested approximately _____ applications during the last year

Comment:

Electronic mail system

23. How long have you been using email (MMM, MMC or some other mail system)?

    I have used email approximately _____ years (or _____ months).

24. How often do you check your email?

    ❑ Less often than once a week.

    ❑ Once a week.

    ❑ Several times a week.

    ❑ At some occasion during the day.

    ❑ Several times a day.

    ❑ Continuously, incoming email may interrupt other tasks.

    ❑ Other way: _____

    Comment:

25. How large amount of the email messages that you send contain information created with other programs than the email program (e.g. word processor, drawing tool)?

    ❑ 0% (skip until question 27).

    Approximately _____ % of the messages that I send contains information created with other programs than the email program.

26. How does it work to send information created with other programs in email messages? Please grade on a scale from one to five, where one is very poor and five is very good.

    In MMM/MMC:

    Very poor 1 2 3 4 5 Very good

    In Lotus Notes (please answer only if you use Lotus Notes):

    Very poor 1 2 3 4 5 Very good

27. How often do you get email <u>delayed</u> for technical reasons?

Never	A few times per year	quarter	month	week	Daily
❑	❑	❑	❑	❑	❑

    Comment:

28. How often do you have a need to read your email at other sites than your ordinary workplace?

Never	A few times per year	quarter	month	week	Daily
❑	❑	❑	❑	❑	❑

29. Do you use email via a modem? If so, please state where (several alternatives possible):

❑ No

❑ Yes, at work
❑ Yes, at home
❑ Yes, during vacation
❑ Yes, during travel in work

Other: _____

30. How do you do in order to store mail addresses to people you communicate with (several alternatives possible)?

❑ Replies directly to messages

❑ Search in old messages for addresses

❑ Use electronical address book

❑ Use paper address book

❑ Remember addresses or aliases

❑ Other: _____

Comment:

31. What percentage of your email are you the sole recipient of?

Approximately ___ % of my email messages are addressed solely to me

32. What percentage of your incoming email are information that you really do not want to read (e.g. unneccesary carbon copies (cc), information that arrives too soon or too late)?

Approximately ___ % of my email messages is more or less unneccesary for me to read

Comment:

33. What percentage of your incoming email would, according to your opinion, be better to distribute in another way (e.g. via an electronical bulletin board)?

    Approximately ___% of my email messages would be better to distribute in some other way.

    ❑ Do not know.

    Comment:

34. What percentage of your email is sent to the other MainframePC site?

    Approximately ___% of my email messages are sent to the other MainframePC site.

35. What percentage of your email is sent to recipients outside MainframePC?

MMC-users outside MainframePC	_____%.
MMM-users outside MainframePC	_____%.
Others outside MainframePC, within Sweden	_____ %.
Others outside MainframePC, outside Sweden	_____ %.

    Comment:

Email handling

36. Some email messages can take a long time to handle. How long do you normally keep email messages before they are completely handled, in other words: how long is your backlog?

    My backlog is normally approximately ___ days (or _____ weeks).

    Comment:

37. How long does it normally take for your colleagues to answer email messages that you send before you get an answer, in other words: how long are your colleagues' backlogs on average?

    My colleagues backlog is normally approximately ___ days (or _____ weeks).

    Comment:

Store

38. How large amount of your incoming email messages do you store initially?

❑ Store everything.

❑ Store some email messages.

❑ Delete most messages after handling them.

❑ Delete all messages after handling them (skip until question 40).

❑ Other: _____

Comment:

39. Why do you store email messages? State with an approximate percentage. The sum does not have to be 100%.

To be certain of what has been said/written. _____ %.

The messages contain information that I probably will need in the future. _____ %.

I store messages that I probably will not have any use for in the future. _____ %.

I use email messages as a "to do" list. _____ %.

Other: _____ _____ %.

Comment:

40. How many email messages do you normally have in the inbox (un-categorised in Notes)?

I have _____ messages in my inbox in MMM/MMC.

I have _____ un-categorised messages in Lotus Notes.

Comment:

If you do not use folders or categories, please skip to question 49.

41. How many email messages do you have stored in total?

I have totally _____ messages stored in MMM/MMC.

I have totally _____ messages stored in Lotus Notes.

42. What percentage do you store of the outgoing messages?

❑ 0% (skip until question 44).

I store approximately _____ % of the outgoing messages.

43. Where do you store the messages that you send?

Folder/category for outgoing messages ❑

Same folder/category as incoming messages ❑

Other: _____

Organise

44. How do you organise the incoming messages (several alternatives possible)?

❑ Not at all (skip until question 49).

❑ All in same folder/category.

❑ According to date (e.g. a folder/category for each month)

❑ After subject.

❑ After sender.

❑ Other: _____

Comment:

45. How many folders/categories do you have totally today?

I have approximately _____ folders in MMM/MMC.

I have approximately _____ categories in Lotus Notes.

46. How many of your folders/categories are of no use to you currently?

I have approximately _____ superfluous folders in MMM/MMC.

I have approximately _____ superfluous folders in Lotus Notes.

Comment:

47. How often do you have problems with sorting/categorising incoming messages?

❑ Never (skip until question 49).

A few times per year	quarter	month	week	Daily
❑	❑	❑	❑	❑

48. Please give examples of your problems with sorting/categorising incoming messages.

_____

_____

_____

Cleaning

49. How often do you do clean-ups (delete old email messages, sort messages in folders/categories) normally?

❑ Never (skip until question 50)

A few times per year	quarter	month	week	Daily
❑	❑	❑	❑	❑

Comment:

50. Would you appreciate if your messages were stored temporarily in a waste basket for e.g. a month when you have deleted the messages, so that you in a case of emergency would be able to retrieve deleted messages during this period? Please grade on a scale from one to five, where one is no use and five is very useful.

No use 1 2 3 4 5 Very useful

Comment:

Search

51. How often do you search among old stored messages?

❑ Never (skip until question 53).

A few times per year	quarter	month	week	Daily
❑	❑	❑	❑	❑

52. How do you search among stored messages (several alternatives possible)?

❑ Manually.

❑ Search tool/function.

❑ Other: _____

Comment:

Miscellaneous

53. How would you prefer to learn Lotus Notes (several alternatives are possible)?

❑ Demonstration in a large group for approximately 2 hours.

❑ Half day or ❑ whole day course.

Use self-study material ❑ on-line or ❑ on paper.

❑ Trail and error.

❑ Ask colleagues.

❑ Read manuals.

❑ Ask help desk.

❑ Use on-line help.

Other: _____

Comment:

Please answer following questions even though you think you know too little.

54. What do you think are the advantages of Lotus Notes?

_____

_____

_____

55. What do you think are the disadvantages of Lotus Notes?

_____

_____

_____

56. What use do you think MainframePC can have of Internet?

_____

_____

_____

Thank you for answering the questionnaire!

B MainframePC diary protocol

The diary presented on the following page is an example of a diary used at the end of the MainframePC study. In the beginning the diary protocols were identical to the protocols used in the Jonrad study.

Diary protocol

Date_____ 1998 Subject #_____

Please mark with a dash for every new message, fax, phone call and meeting.

	# of items in			Sum
	MMM	MMC	Notes	
Received email messages (except reception receipts)				
Sent email messages				
# of recipients of email messages				
Deleted email messages				
Total # of email messages				
# of email messages in inbox				
Received mail				
Sent mail				
Received fax				
Sent fax				
Phone calls (in- and out)				
Planned meetings (summon distrib-uted in advance)				
Un-planned meetings				
Searches in databases				

Do you had any problems today with:

Handling Notes (interface, functions)

No ❑ A little ❑ A lot ❑ Severe problems with the application ❑

Handling the incoming email messages (read, answer, store, delete)

No ❑ A little ❑ A lot ❑ Severe problems with the flow ❑

Sort email (categorise, create categories, delete categories)

No ❑ A little ❑ A lot ❑ Severe problems with sorting ❑

Please describe eventual problems_____

How filled has your day been?

Not at all ❑ A little ❑ A lot ❑ Overfilled ❑

C Jonrad diary example

The diary presented on the following two pages is an example of a diary used in the Jonrad study. Initially the diaries at MainframePC were identical to this Jonrad diary, but the diversity of mail tools at MainframePC forced me to change the diary there.

When the protocol was returned with changes in the categories, these categories were entered in a separate file for each participant in the longitudinal study in order to minimise the work for the participants.

Diary protocol

Date_____ 1998 Subject #_____

Please mark with a dash or write the number for every new email, letter, fax, phone conversation and meeting.

	# of items	Sum
Received email (reception receipts do not count)		
Sent email		
# of recipients of email		
Deleted email		
Received mail		
Sent mail		
Received fax		
Sent fax		
Phone calls (in- and out)		
Planned meetings (a summon has been distributed in advance)		
Un-planned meetings		
Searches in Notes databases		

Do you had any problems today with:
Handling Notes (interface, functions)

No ❑ A little ❑ A lot ❑ Severe problems with the application ❑

Handling the incoming email messages (read, answer, store, delete)

No ❑ A little ❑ A lot ❑ Severe problems with the flow ❑

Sort email (know how an email should be categorised, create categories, failed categories)

No ❑ A little ❑ A lot ❑ Severe problems with sorting ❑

Please describe eventual problems_____
How filled has your day been?

Not at all ❑ A little ❑ A lot ❑ Overfilled ❑

Please enter the number of messages in each category. If you have added new categories, please enter their names and number of messages. Strike out categories you have deleted.

Categorised email messages, subject 25, Date 98 ___

Category	# of messages
Uncategorised/Inbox	
Care programs	
Cooperation group	
County group	
District management	
Division management	
Economy	
Education	
FSG-protocol	
HR-management	
IT	
My Own Folder	
Salaries	
Statistics	

D Jonrad Primary Care Centre questionnaire

The following questionnaire was distributed by the head manager of the five studied primary medicare centres to all medical staff (cleaning personnel excluded).

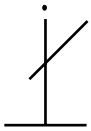
Written communication and attitudes towards computers

This questionnaire is aimed to employees of one of five selected primary medicare centres and as a part of a research project at the Royal Institute of Technology in Stockholm. The purpose is to examine attitudes to computers and written communication. Since we know that you have to fill in questionnaires constantly, have we made this one as short as possible. If you have any questions, please contact Olle Bälter on 08-790 91 57 or 0707-51 85 88.

1. Age:_____ years.
2. ❑ Woman ❑ Man.
3. What do you work as?
   Assistant nurse❑, Dietician❑, District nurse❑, Doctor❑,
   Laboratory assistant❑, Occupational therapist❑, Physiotherapist❑,
   Midwife❑, Nurse❑, Secretary❑, Trained nurse❑, Welfare officer❑,
   Other:_____
4. How many years have you worked totally with medicare? _____ years.
5. How often do you write letters or reports (at work, home, by hand, machine, or computer)?
   Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
6. How often do you use the computerized case record at your workplace?
   Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
7. How often do you use the computerized calendar at your workplace?
   Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
8. How often do you use computer programs in general (including at home, e.g. word processing, spreadsheets, games)?
   Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
9. How often do you use electronic mail (at work or home)?
   Do not have access to electronic mail❑ ,
   Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
10. According to your opinion, do you regard your knowledge of computers as adequate for your work tasks?
    Agree completely❑ , partly ❑, not at all❑.
11. How often do you use computers at home?
    Do not have a computer at home❑,
    Never❑. A few times a year❑, month❑, week❑, day❑. Several times a day❑.
12. Please describe your attitude towards computers in general:

Thank you for your cooperation!

Olle Bälter was born in 1962 in Umeå in northern Sweden. After studying Mathematics for a year at Umeå University, he achieved a Masters Degree in Engineering Physics in 1986 at the Royal Institute of Technology in Stockholm, Sweden. He has worked for several years as a systems engineer at Siemens and received awards for pedagogical achievements at the Royal Institute. His spare time is devoted to volleyball, catamaran sailing, student farces, and globetrotting.



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