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# **The Cost Effectiveness of Electronic Communication**

By

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A Doctoral Thesis

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## Abstract

Electronic communication is becoming an integral part of the communication structure within organisations, but the costs and benefits are not being assessed. Communication by email is usually assumed to be an efficient and effective means of sending messages. However, on analysis the process is seen to be much more complex and much less efficient than is normally assumed. Communication is carried out in many different forms, but the common underlying motive of communication is to improve working practices and to increase productivity. As communication pervades nearly everything we do, even small improvements in the effectiveness and cost of our communication processes can have significant benefits. The aim of this research was to analyse the cost effectiveness of using email and to suggest ways in which the cost effectiveness can be improved.

A number of studies have been conducted into the cost effectiveness of email within organisations. The studies were carried out mainly at the Danwood Group, the company sponsoring the author's PhD research. The Danwood Group has just over 500 employees at 19 sites around the UK and its head office is based in Lincoln, where all of the email case studies in this thesis were undertaken. The Danwood Group retails office equipment, predominately photocopiers.

Email behaviour was monitored by the use of software at the Danwood Group. This raised a number of questions on the ethical issues of electronic monitoring. This thesis explores these issues and proposes a set of guidelines to allow electronic monitoring within strict professional and ethical guidelines.

The Danwood Group studies examined how and when email was used. It was found that, when the company first started using email, over two thirds of messages were non-business-related, though this dropped to less than half in a few months. It was also

found that many messages could be delivered in one line of text. A one-line message service was introduced and this was found to save employee time for both senders and receivers of the messages.

A costing formula was developed measuring the human cost of operating email messaging. The final study was to determine how long it took employees to recover and return to normal work after an email interruption and this was compared with published data for telephone interrupts. From these results a set of guidelines were developed to enable companies to make the most efficient use of email.

The thesis concludes by identifying further areas of research into email usage that would help give a better understanding of methods to enable email to become even more cost effective.

### **Chapter Keywords**

Email Monitoring Guidelines, Email Costing Formula, One-Line Emails, Email Usage Guidelines

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## Publications

The research carried out as part of this thesis has led to the following publications and conference presentations:

### Journal Publications:

- Jackson T.W., Dawson R., and Wilson D. 2001. "The Cost of Email Interruption." *The Journal of Systems & Information Technology* 5:81-92.

### Conference Proceedings:

- Jackson T.W., and Dawson R. 1999. "The Need for Computer Scientists to Receive Training on People Skills." Pp. 67-71 in *Psychology of Programming Interest Group*, edited by Green T., Abdullah R., and Brna P. University of Leeds.
- Jackson T.W., Dawson R., and Wilson D. 1999. "Improving the Communications Process: The costs and effectiveness of email compared with traditional media." Pp. 167 - 178 in *INSPIRE - Training and Teaching for the understanding of Software Quality*. Crete.
- Jackson T.W., Dawson R., and Wilson D. 2000a. "The Cost of Email Within Organisations." Pp. 1093 - 1094 in *Challenges of Information Technology Management in the 21st Century*. Alaska.
- Jackson T.W., Dawson R., and Wilson D. 2000b. "Downsizing Electronic Mail can Optimise Company Communications." Pp. 131 - 141 in *INSPIRE - Training and Teaching for the understanding of Software Quality*. University of North London.
- Jackson T.W., Dawson R., and Wilson D. 2000c. "E-Communication Analysis: The Cost of an Internal Email Messaging System within Organisations." Pp.

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129 - 140 in *Re-Technologies for Information Systems Preparing to E-Business*. Zurich.

- Jackson T.W., Shah N.N., Dawson R, and Wilson D. 2001. "The Ethics of Electronic Monitoring within the Workplace." Pp. 125-137 in *SQM - Software Quality Management*. Loughborough.
- Jackson T.W., Dawson R, and Wilson D. 2001. "Case Study: Evaluating the use of an Electronic Messaging System in Business." Pp. 54-57 in *EASE 2001*. Keele.

## CHAPTER 1- INTRODUCTION

### Chapter Preface

This chapter puts the work of this thesis into an overall context. It begins by introducing the need to understand the information age and electronic communication within organisations. It reviews existing research and outlines the requirement to further understand the cost effectiveness of electronic communication in the form of aims and objectives.

### Chapter Keywords

Electronic Communication, Cost

### 1.1 Introduction

This thesis has been created through drawing both from personal experience in industry and from literature. Most of the author's time over the last three years has been spent at the Danwood Group's head office, which is based in Lincoln in the United Kingdom. The Danwood Group, which sponsored the author's PhD, has nineteen branches, over five hundred employees and is the largest independent supplier of office equipment in the United Kingdom. Predominately Danwood sell photocopiers, but they also sell office furniture. Their annual turnover is in excess of thirty five million pounds a year on photocopier sales and servicing, and three million pounds a year on office furniture. This thesis addresses the issues of electronic mail (email) and the cost effectiveness of its presence within the workplace. All of the case studies within the thesis have been undertaken at the Danwood Group head office complex, which comprises three main offices on one site, Harrison Place, Eyre Court and Whisby Way.

Living in the information age can occasionally feel like being driven by someone with tunnel vision. That unfortunate disability cuts off the peripheral visual field allowing



sufferers to see where they want to go, but little besides. Add the information age together with the complexities of communicating, and the workplace can become a difficult place to work. Historians frequently trace the beginnings of the information age not to the Internet, the computer, or even the telephone, but to the telegraph. With the telegraph, the speed of information essentially separated itself from the speed of human travel. People travelled at the speed of the train. Information began to travel at close to the speed of light, which started to change the way communication took place. It has long been clear that email is more than just a simple communication system (Mackay W. 1998), (Whittaker S. and Sidner C. 1996). Email has become a central element of the way work is conducted in organisations where computers are used. It is now the source of many different office tasks, serving as the place in which work is received and delegated (Whittaker S. and Sidner C. 1996). For today's computer user at work, email is much more than an ordinary application. It has become a part of the working habitat (Bellotti V. and Smith Ian. 2000).

Computer-mediated communication (CMC), such as email, has greatly challenged our old communication styles. Behaviours such as social cues are no longer helpful in accurately emphasizing or conveying messages to others, as they are said to be when communicating face-to-face (Kiesler Sara 1986). Computer keyboards and monitor screens have eliminated the use of our hands, voices, facial expressions and body movements in the effort fully to emphasize or convey a point. The implications of this communication trade-off when using CMC are great, as many organisations are turning to advanced electronic media, such as email, to shed excess costs and respond more nimbly to customers and competition (Markus L.M. November 1994). Email, as a growing number of studies suggest, is rapidly becoming the principal means of distance communication for today's computer-literate professional, surpassing the telephone in terms of the number of communications made each day (Markus L.M. November 1994), (Bellotti V. and Smith Ian. 2000). Email lowers the cost of coordination, and many professionals spend a greater part of their day communicating over email than even face-to-face (Sproull L. and Kiesler S. 1991). Electronic mail

distinguishes itself from other communication media, as it allows individuals to communicate more quickly and efficiently than ever before. However, the costs and effectiveness of email compared with traditional media are still to be empirically assessed. A number of reports have been published into the amounts of money companies lose when their email systems fail and the costs of running email systems in terms of hardware (New Creative Networks 2000), (New Creative Networks 1999), though little empirical research has been conducted into the cost of human-email application interaction and the effect of email on the workplace.

There are many claimed benefits of email. For instance, it allows people to work as a team even when members are remote, and the sharing of information is much easier whether it is on another floor or in another time zone (Hein Kenneth. 1996). Additionally, email allows individuals to spend less time dictating letters, waiting for phone calls and sending documents by regular mail (Hunt E. 1996). Simultaneous transmission ensures that everyone receives the same message at the same time, incurring lower costs when exchanging information. Yet despite the variety and ease of communication facilitated by email, the ability to communicate has not kept up with the rate of technology (Hunt E. 1996). The workplace is a difficult place to work and to communicate at the best of times and by adding a communication tool that records every message sent and received means careful consideration has to be given to any communicated message.

As organisations gear up for the implementation of new electronic communication technology, their email education is focusing on the hardware and software issues without regard for the requisite communication skills (Nantz K.S. and Drexel C.L. 1995). In support, a study conducted by Diane B. Hartman of Quality Training International and Karen Nantz of Eastern Illinois University found that 77% of respondents receive email training, but this was mostly focused on equipment and software instruction (Gillian 1995). Organisations need a more holistic approach (Davenport T.H. 1997), one that recognises electronic communication skills as a



crucial variable in the effective implementation and use of computer-assisted communication media. Hardware and software training is unquestionably needed in an implementation of this sort, but individuals also need to understand how the technology changes the communication process (Nantz K.S. and Drexel C.L. 1995) and how users can deal with those changes. As part of the research carried out for this thesis, one of the studies concentrated on trying to educate users to become better communicators through using bespoke email software. The author created the bespoke email software specification, and an undergraduate at Loughborough University constructed the program as part of his final-year project. The software encouraged users to create better structured email messages. The results, which can be found in Chapter 7, were very encouraging. Another study, also part of this research, described in Chapter 8, highlighted the need for employees to receive email application and communication training. After monitoring the employees using their email applications, it was clear that, through a small amount of employee training, employees could become more effective at communicating and that their productivity could increase. Understanding electronic communication and the patterns that characterise its development are critical to realising the full benefits from computer-supported work (Eveland J.D. and Bikson T.K. 1987). One advantage of electronic mail is that it is asynchronous in nature. Messages can be sent at the convenience of senders and read at the convenience of recipients (Kiesler Sara 1986). Recipients have the luxury of taking their time and responding to incoming electronic mail messages once replies have been well thought out and formulated (Sproull L.S. 1986). The research carried out into interrupt recovery times for email interrupts, reported in Chapter 8, actually showed that the majority of email recipients would read their email on arrival, interrupting their current work and affecting their productivity. To try to increase employee productivity, a set of guidelines were produced and have been included as part of Chapter 8.

With some 38 million workers using email networks in 1996, and with an estimated 72 million workers connected in 2000, (Hein Kenneth. 1996), determining the cost-effectiveness of email will make a significant contribution to basic and applied

research. With the widespread surge of virtual workplaces, on-line communities, discussion groups and listserves, it is important that organisations begin to identify ways in which behaviour and culture must change if their information initiatives are to succeed (Davenport T.H. 1997). Organisations can greatly benefit from such research, as individuals increasingly rely on computer technology for negotiation and decision making which are critical to successful business functioning. The overemphasis on technology eventually even reflects poorly on technology itself, because non-technologists assume that their inability to get the information they want is due to inadequate systems (Davenport T.H. 1997). By understanding the dimensions of effective electronic communication, email users can enjoy and reap all of the benefits that computer-mediated communication technology provides. The research within this thesis has helped to improve effective communication at the Danwood group and, following the numerous enquiries from the author's web site regarding the email guidelines set out in Chapter 8, there is an expected benefit for all companies that implement them.

## 1.2 The Background to Email

Three times, or maybe four, in recent history a new technology has been introduced that has fundamentally transformed human society by changing the way people communicate with each other. There was Samuel B. Morse and the first telegram. Delivered on May 24, 1844, the message read "What hath god wrought!". Following Morse there was the dawn of the telephone era, heralded by Alexander Graham Bell's legendary summons to his assistant on March 10, 1876: "Mr. Watson, come here; I want you". Following the telephone, in 1895 there was the first wireless transmission by Guglielmo Marconi (Campbell T. 1998).

Sometime in late 1971, a computer engineer named Ray Tomlinson sent the first email message. He sent a number of test messages to himself from one machine to another, and his first message was "QWERTYUIOP" (Campbell T. 1998). Ray Tomlinson is



not well known, like Morse and Bell, but he created the way email recipients are addressed. He picked the @ symbol as the locator in electronic addresses. His invention undoubtedly launched the digital information revolution, and yet the breakthrough he made was such a simple evolutionary step that hardly anyone noticed it until later.

Tomlinson worked for Bolt Beranek and Newman (BBN), a company hired by the United States Department of Defense in 1968 to build the ARPANET (Advanced Research Projects Agency Network), the forerunner to the Internet. In 1971 he was updating an electronic message program called SNDMSG (Send Message), which he had written to allow programmers and researchers who were working on Digital PDP-10s (early ARPANET computers) to leave messages for each other. Like a number of then existing electronic message programs, the oldest dating from the early 1960s, SNDMSG only worked locally. It was designed to allow the exchange of messages between users who shared the same machine. Such users could create a text file and deliver it to a designated "mail box". A mailbox was simply a file with a particular name. Its only special property was that users could write more material onto the end of the mailbox, but they could not read or overwrite what was already there.

When Tomlinson sat down to update SNDMSG, he had been working on an experimental file transfer protocol called CYPNET, for transferring files among linked computers at remote sites within ARPANET. At the time, the ARPANET consisted of 15 nodes, located at places like UCLA (University of California, Los Angeles) in California, the University of Utah in Salt Lake City, and at BBN in Cambridge, Massachusetts. The way CYPNET was originally written, it sent and received files, but had no provision for appending a file to the message. Tomlinson set out to adapt CYPNET to use SNDMSG to deliver messages to mailboxes on remote machines, through the ARPANET. First, he chose the @ symbol to distinguish between messages addressed to mailboxes in the local machine and messages that were heading out onto the network. Then Tomlinson sent himself an email message. BBN had two PDP-10



computers wired together through the ARPANET. The message travelled on the network between the two machines in the same room in Cambridge.

Once Tomlinson was satisfied that SNDMSG worked on the network, he sent a message to colleagues letting them know about the new feature, with instructions for placing an @ between the user's login name and the name of Tomlinson's host computer. Two years later, a study found that 75 percent of all traffic on ARPANET was email. It took almost five years for the builders and designers of ARPANET to sit back and realise that in many ways email had become the real reason for the new computer network.

In a paper published in 1978 by the Institute of Electrical and Electronic Engineers, two of the important figures in the creation of the ARPANET, J. C. R. Licklider and Albert Vezza, explained the popularity of email. "One of the advantages of the message systems over letter mail was that, in an ARPANET message, one could write tersely and type imperfectly, even to an older person in a superior position and even to a person one did not know very well, and the recipient took no offence. Among the advantages of the network message services over the telephone [was] the fact that one could proceed immediately to the point without having to engage in small talk first, that the message services produced a perceivable record, and that the sender and receiver did not have to be available at the same time" (Licklider J. C. R. and Vezza. Albert. 1978).

Today there are currently 21 million people in the UK that have access to the Internet (Nua Internet 2001). According to the latest findings Europeans use email much more than US Internet users. The French lead the way, with nearly two-thirds (64 percent) sending and receiving email in August 2001, followed by the UK (60.3 percent) and Germany (53.5 percent). In the US, however, less than half (44 percent) of those connected to the Internet used email (Nua Internet 2000). The International Data Corporation (IDC) has predicted that 35 billion emails will be sent every day by 2005.

At the end of 2000, the figure stands at 10 billion. IDC's Email Usage Forecast and Analysis report further estimates that the number of emails sent annually in Western Europe will be 1.6 trillion in 2005, up from 511 billion in 2000 (Nua Internet 2000).

### 1.3 Aims and Objectives

While technology continues to be faulted for ineffective and costly communication, it is possible that the greater problem may in fact lie with the communicator. Individuals can be more effective with information technology by learning to fine-tune their fundamental communication skills and by adopting email-specific communication skills to enhance their messaging. The specific knowledge of these skills, therefore, becomes critical to achieving better quality communication. It is this very gap that these exploratory studies hoped to fill, by highlighting the specific variables associated with the cost of email effectiveness. The underlying aim of the thesis is to answer the questions:

1. How can the cost-effectiveness of email use be determined?
2. How can the cost-effectiveness of email use be improved?

In the terms of this thesis "cost-effectiveness" has meant the resulting costs of using email. The word cost in "cost-effectiveness" has been broken down into two parts.

1. "Soft" Cost Values

These values are difficult to measure. They include, for example, the social impact of using email in the workplace or the social learning that is gained through using the email system.

2. "Hard" Cost Values

These values are easier to measure. They include, for example, the amount of time employees spend using an email system or the cost to employ an employee in terms of wages per month.

To move towards these aims the specific areas of this research have been defined as follows.

1. To examine the “hard cost values” of email using a case study of a working environment to gain a better understanding of how email is used.
2. To quantify, in a case study, the level of interruption to an employee’s work caused by email, including any associated interrupt recovery time.
3. To develop, using the experience of the case study, ethical guidelines for monitoring employees’ use of electronic communication.
4. To develop an email usage costing formula, based on the “hard cost values” and interrupt data obtained, to help focus on optimising the email system for maximum effectiveness and efficiency with respect to employee time.
5. To determine if the email software used can be modified to encourage users to produce more effective communication.
6. To develop guidelines for managing electronic communication within the workplace to improve email use to give greater effectiveness and efficiency with respect to employee time.
7. To determine what employee training would give greater effectiveness in the use of email and efficiency with respect to employee time.

The following is the general hypothesis of the research.

*By examining the “hard cost values” of email use in the workplace, areas of improvement in the use of email for both sender and receiver can be identified that will give a significant improvement in its effectiveness and efficiency with respect to employee time.*

The achievement of the objectives, and the confirmation of the hypothesis, will not in themselves totally achieve the overall stated aim of determining the cost-effectiveness of electronic communication. To achieve this aim, investigation of the “soft cost



values” will be required, as will an investigation of alternative communication methods such as telephone, memos and face-to-face communication. It would also be necessary to examine a wider range of users beyond the single case study company involved in this research and to examine whether the different types of users and organisations affect the results. However, this research should provide valuable information to help establish means of improving the cost-effectiveness of electronic communication within an organisation, especially for any organisation similar to the one studied.

## 1.4 Thesis Layout

All of the Chapters except 1, 2, 3 and 9 are based on published journal or conference papers. Each chapter is summarised below, with the details of the original paper on which each is based.

### *1.4.1 Chapter 2 Literature Review*

This chapter contains literature reviews for the four main research areas within this thesis, which are email monitoring guidelines, email costing formulae, one-line emails and email usage guidelines.

### *1.4.2 Chapter 3 Methodology*

This chapter describes the research methodology for the thesis. It contains the research philosophy adopted and the research strategy employed in the pursuit of the research objectives and in the quest for the solution to the research question.

### *1.4.3 Chapter 4 The Ethics of E-monitoring the Workplace*

This chapter is based on the “The Ethics of Electronic Monitoring within the Workplace” paper, which was presented at the Software Quality Management conference in April 2001 (Jackson T.W. et al. 2001). Chapter 4 raises the ethical issues behind monitoring employees within the workplace. Through the use of case studies,

recommendations for company policy on electronic monitoring, and a reasonable code of ethics that companies should endorse, have been created.

#### *1.4.4 Chapter 5 Electronic Monitoring Software*

The chapter is based upon the paper “Case Study: Evaluating the Use of an Electronic Messaging System in Business” presented at the EASE 2001 conference (Jackson T.W., Dawson R and Wilson D. 2001). This chapter shows the processes involved in both developing software and evaluating off-the-shelf applications that were used for electronically monitoring employees’ email usage. It was important to minimise the amount of intrusion into employees’ personal privacy due to the adverse effects that arise when employees know that they are being monitored.

#### *1.4.5 Chapter 6 Electronic Communication*

This chapter is based on four papers, “Improving the Communications Process: The Costs and Effectiveness of Email Compared with Traditional Media”, “E-Communication Analysis: The Cost of an Internal Email Messaging System within Organisations”, “The Cost of Email within Organisations” and “Case Study: Evaluating the Use of an Electronic Messaging System in Business” (Jackson T.W., Dawson R. and Wilson D. 1999), (Jackson T.W., Dawson R. and Wilson D. 2000c), (Jackson T.W., Dawson R. and Wilson D. 2000a), (Jackson T.W., Dawson R and Wilson D. 2001). Chapter 6 provides a detailed view of the metrics obtained by the various applications described in Chapter 5. It shows the amount of business and non-business email dealt with at different times in the email system lifecycle. The chapter concludes with an email usage costing formula based on both business and non-business email.

#### *1.4.6 Chapter 7 Short Messaging Service for Email*

This chapter is based on the “Downsizing Electronic Mail can Optimise Company Communications” paper, which was presented at the Inspire conference in September 2000 (Jackson T.W., Dawson R. and Wilson D. 2000b). Chapter 7 determines if email training can be administered through software. A new email add-on was developed to take advantage of single-line emails, giving a service that would send one-line messages at a high priority and display them in receivers’ Inboxes. The chapter concludes that the service was time-saving and also led to better structuring of email messages.

#### *1.4.7 Chapter 8 The Cost of Interrupt Recovery Time*

This chapter is based on the papers “The Cost of Email Interruption”, published in a special edition of the JoSIT journal, and “The Ethics of Electronic Monitoring within the Workplace” , presented at the Software Quality Management conference in April 2001 (Jackson T.W., Dawson R. and Wilson D. 2001), (Jackson T.W. et al. 2001). Chapter 8 determines if there is an interrupt recovery time associated with an email interruption and the associated consequences. A research study was set up to monitor employees’ interaction with email applications and to discover if there was an interrupt recovery time associated with an email interrupt.

#### *1.4.8 Chapter 9 Summary, Conclusions and Recommendations for Further Work*

This chapter summarises the whole thesis, relating the work to the aims and objectives set out in Chapter 1.

#### *1.4.9 Appendix 1*

Appendix 1 contains a copy of the Email Short Message Service (SMS) questionnaire which was used to gain some of the data for the results shown in Chapter 7. The questionnaire contained questions about the SMS application that the employees used.



*1.4.10 Appendix 2*

Appendix 2 contains a copy of the form that was used to record employees' email interaction, which is described in Chapter 8.

*1.4.11 Appendix 3*

Appendix 3 contains samples of communications received regarding the research described in the thesis. The majority of the comments were received via the author's web site ([www.bigfoot.com/~tomjackson](http://www.bigfoot.com/~tomjackson)).

*1.4.12 Appendix 4*

Appendix 4 contains the user guide for the Danwood SMS Email application.

*1.4.13 Appendix 5*

Appendix 5 contains the program specification for the Danwood Mail application.

*1.4.14 Appendix 6*

Appendix 6 contains the program specifications for the SLMail In and SLMail Out applications.

*1.4.15 Appendix 7*

Appendix 7 contains the program specification for the POP3 Mail application.

*1.4.16 Appendix 8*

Appendix 8 contains the program specification for the Danwood One-Line Email application.

*1.4.17 Appendix 9*

Appendix 9 contains the reviewed programs that were considered for the research of monitoring email users at the Danwood Group.

*1.4.18 Appendix 10*

Appendix 10 contains the program specification for the Email Pickup Times application.

*1.4.19 Appendix 11*

Appendix 11 contains the program specification for the Mobile Phone Analysis application.



## CHAPTER 2 - LITERATURE REVIEW

### Chapter Preface

This chapter contains a literature review for the proposed research. The chapter starts with a general overview of communication research and then looks closely at the four main research areas of email monitoring guidelines, email costing formulae, one-line emails and email usage guidelines.

### Chapter Keywords

Email Communication, Media Selection, Interrupt.

### 2.1 Introduction

Human communication is a dynamic ongoing process. It is the process that enables employees to work together to achieve cooperation and to interpret ever-changing workplace needs and activities. The word 'communicate' is itself a semantic trap. As an active verb its purpose is to give information about the subject of the verb, the communicator, but by definition communication is a two-party activity, which requires a receiver as well as a transmitter. Human communication does not start and stop. People are constantly involved in communicating with themselves and with others, especially in the workplace. They are immersed in a sea of messages and meanings. Employees must be able to recognise and interpret the wide variety of messages available to them that enable them to respond appropriately to different people and situations. No one can choose not to communicate. Communication is an inevitable reality of organisational membership and of life in general. Human beings cannot not communicate (Watzlawick P., Beavin J. and Jackson D. 1967). As long as you are alive, you are involved in some means of communication, even if it is only communicating with yourself.

Effective communication has positive returns and, by executives' own vote, no aspect of a manager's performance is of greater importance to his or her success than communication (Fielden 1980). In the Harvard Business Review article, "What helps or harms promotability?", Garba Bowman (1964) discovers the qualities that characterise promotable executives. She reports that the ability to communicate is at the highest rung (out of 8 rungs) of the ladder to promotion. From the lowest to highest rung, the ladder begins with qualities such as the capacity for hard work, getting things done with and through people, good appearance, self-confidence, making sound decisions, college education, ambition and drive, and then finally the ability to communicate. With the widespread acceptance of computer-mediated communication technology, it stands to reason that the ability to communicate will also reflect the ability to communicate effectively with all types of communication media available.

Much of the research in the field of computer-mediated communication focuses heavily on learning which communication medium will best serve an individual or a group's requirements. To date, it seems that media choice is based mostly on technical and task characteristics. This method of selection, however, may not lead to the best media choice. The existing body of research has fallen short of looking at the effect an individual's computer communication skills might have on overall outcome. Regardless of the proper choice of communication medium or richness of that medium, an employee must first be a good communicator to achieve the desired results. The following literature review highlights the most influential theories in computer-mediated communication.

### *2.1.1 Information and Media Richness*

Much of the research on computer-mediated communication focuses on its technical advantages and disadvantages when compared to other media, such as face-to-face interaction. The critical difference between these two media choices, according to Sproull and Kiesler (1986), is that computer-mediated communication lacks the "social



context cues” that make face-to-face interaction so effective in many situations. In one of the most influential theories in computer-mediated communication, Daft and Lengel (1986) claim that the non-verbal cues inherent in face-to-face communication make this a “richer” media choice than computer-mediated communication. Thus, many researchers judge computer-mediated communication to be a very lean channel because non-verbal cues are absent.

### 2.1.2 *Media Selection*

Organisations must be aware of the costs of choosing inappropriate media channels. The mismatch between the communication media and the nature of the communication task will most likely result in an undesirable outcome (Daft R.L. and Lengel R.H. 1986). Schmitz and Fulk (1991) report that rich media are more effective in reducing high levels of ambiguity, but these are deemed more costly than “lean” media. For example, rich communication media may prove to be inefficient for communication tasks low in ambiguity. When other forms of communication media (e.g. electronic mail) are at an employee’s disposal, communication tasks can be handled effectively without incurring large travel or telephone expenses. Valacich, Paranka, George and Nunamaker (1993) found that groups using electronic mail for a task of low ambiguity outperformed groups using a richer, verbal communication (e.g. face-to-face meeting).

As new communication methods are introduced into organisations it is important to understand how and why employees use the new media (Markus L.M. November 1994), as it is not the media *per se* that determine communication patterns, but rather the social processes surrounding media use (DeSanctis G. and Poole M.S. 1994). By understanding communication methods, the media can be optimised to enhance performance within organisations. Through the decades organisations have changed the way they have chosen to communicate due to quantum leaps in communication technology. From the introduction of the printing press to the Internet, Email, WAP (Wireless Application Protocol) and traditional face-to-face communication, there is still a common underlying requirement to communicate. In organisations,

communication processes underlie how strategy is devised and implemented, employees are led and motivated, operations are controlled and decisions are made. The rise in the use of electronic communication is a relatively new development, so companies are in the process of learning how to make best use of this medium. As a result the selection of communication media and its use in organisational tasks has become an important area of research (Markus L.M. November 1994), (DeSanctis G. and Poole M.S. 1994), (Daft R.L. and Lewin A.Y. 1993).

### 2.1.3 *Usage*

It is said that senior managers use rich media proportionately more than employees lower on the corporate ladder, because managers are faced with a greater amount of ambiguity (Daft R. and Lengel R. 1984). That is, managers report that they are more likely to use face-to-face for ambiguous communication tasks and to use written or electronic media for unambiguous communication tasks (Schmitz J. and Fulk J. 1991). In support, Daft and Lengel (1987) found that face-to-face communication was ranked by 100 managers as more likely to be chosen (46%) for communication tasks involving ambiguity than telephone, written messages or email (all round 25%). Further, it was found that email was more likely to be chosen (62%) for tasks involving situational constraints than the other media (telephone 51%, written messages 43% and face-to-face 17%).

A large number of studies have been conducted, particularly since the 1980s, linking a variety of behavioural patterns with the use of computers to mediate communication (Dennis A.R., Haley B.J. and Vanderberg R.J. 1996), (Dennis A.R. and Gallupe R.B. 1993), (Mandviwalla M. and Gray P. 1998). The results of these studies have been explained and summarised through a number of theories of selection and use of communication media in organisations. The following are examples of such theories.



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- **Media Richness Theory.** Daft and Lengel (1986) claim that the non-verbal cues inherent in face-to-face communication make this medium a “richer” choice than computer-mediated communication. Thus, many researchers deem computer-mediated communication a very lean channel because non-verbal cues are absent.
  - **Adaptive Structuration Theory** (DeSanctis G. and Poole M.S. 1994), (Poole M.S. and DeSanctis G. 1990), (Poole M.S. and Jackson M.H. 1993). Adaptive Structuration focuses on the structure that is created and recreated through the generative and adaptive rules and resources of group members. The theory gives examples of, and explains, both stability and change within the group. It also incorporates how work groups incorporate technology into their problem-solving attempts. It is useful in examining the role that power plays in the development of groups. Yet it is difficult to understand how groups can be broken down into separate parts for studying. This theory can also be difficult to understand because of its complexity.
  - **Systems Rationalism** (Lea M. 1991). Systems rationalism can be characterised by an emphasis on the more positive aspects of the potential and possibilities of information technology, especially with respect to economic or organisational efficiency. In addition, this perspective focuses on the computer user while placing less emphasis on broader issues of context. Systems rationalism emphasises positive impacts and assumes there exists a consensus on social goals. It places high emphasis on efficiency and narrow bounds on the role of computing.
  - **Genre-based Communication Structuring** (Orlikowski W.J. and Yates J. 1994). Orlikowski and Yates (1994) have applied the social action notion of genres to organisational communications (e.g. memos, meetings, reports, training seminars, résumés and announcements), and examined these as

socially recognised types of communicative actions habitually enacted by organisational members to realise particular communicative and collaborative purposes. They identify genres by their socially recognised purpose and by their common characteristics of form. The *purpose* of a genre is not an individual's private motive for communicating, but a purpose socially constructed and recognised by the relevant organisational community and invoked in typical situations (e.g. proposing a project, meeting to review project status). *Form* refers to observable aspects of the communication, such as medium (e.g. pen and paper, telephone or face-to-face), structural features (e.g. text formatting devices such as lists and structured fields), and linguistic features (including level of formality, specialised vocabulary, or graphic devices). A genre established within a particular community serves as an institutionalised template for social interaction, an organising structure that influences the ongoing communicative action of members through their use of it within and across their community. Genres as organising structures shape, but do not determine, how community members engage in everyday social interaction.

- **The Affective Reward Suppression Model** (Reinig B.A. et al. 1995). Research by Reinig and colleagues has shown that Group Support Systems (GSS) have dramatically increased group productivity. However, researchers in the field discovered that users sometimes find themselves feeling emotionally unfulfilled despite exceptionally good results; users report a loss of the affective reward often associated with a challenging meeting where they struggle and succeed. This lack of engagement has been shown to be a cause of user resistance to adopting GSS technology. Team effectiveness may be reduced over time as users seek less effective but more gratifying alternatives. The model measures affective reward.



- **Gains and Losses Model** (Nunamaker J.F. et al. 1991), (Alavi M. 1994). The model examines group processes at a low level of detail. Certain aspects of the meeting process improve outcomes (process gains) while others impair outcomes (process losses) relative to the efforts of the same individuals working by themselves or those of groups that do not experience them. Meeting outcomes are contingent upon the balance of these process gains and losses. Situational characteristics (i.e. group, task and context) establish an initial balance, which the group may alter by using electronic meeting systems. There are many different process gains and losses which vary in strength (or may not exist at all) depending upon the situation. For example, in a verbal meeting there may be losses due to air time fragmentation as there may be a requirement to partition speaking time among members, depending upon group size. Air time fragmentation is a greater problem for larger groups, as the available time must be rationed among more people. If everyone in a 3-member group contributed equally in a 60-minute meeting, each person would speak for 20 minutes, while each member of a 15-member group would speak for 4 minutes.

Given the lack of overlap among many of the theories proposed, the general consensus seems to be that "there is no general theoretical consensus" (DeSanctis G. et al. 1993), (Mandviwalla M. and Gray P. 1998).

#### *2.1.4 Areas of Research*

There have been large amounts of research carried out into computer-mediated communication, but the research falls short in answering the aims and objectives outlined in Chapter 1. This thesis has attempted to fill the gap in the existing research by determining how to improve the cost-effectiveness of electronic communication. The research carried out by the author falls into the following four areas.

- Electronic monitoring guidelines

- Internal email costing formulae
- One-line email applications
- Email usage guidelines

The remainder of this chapter has been split into the above four areas and a relevant literature review has been given for each.

## 2.2 Electronic Monitoring Guidelines

Human beings are not always ethical. If we were always ethical there would be no need to discuss ethical matters. Rather, humans sometimes do things that are not fair, not right and not in the best interest of other people or sometimes even themselves. Ethics provide ways of reasoning about what people should do and how they should behave. Information technology adds complexity to the reasoning processes. The problem with knowing the appropriate ethical action with information technologies is twofold. First, information technologies have capabilities that allow IT users to act in ways that affect others, sometimes unintentionally by storing, accessing and using information about them or by developing applications that may be harmful to them (Culnan M. 1993), (Laudon K. 1993), (Loch K.D., Carr H.H. and Warkentin M.E. 1992). The ETHICS method, created by Enid Mumford (1996), goes a long way to helping users understand their actions and the possible consequences they may face. The ETHICS method consists of a set of logical, sequential and analytical steps that are taken when a new computer-based work system is being designed. Through user involvement, effective communication and informed choice the ETHICS method seeks to achieve greater realisation of the advantages of new systems for all their stakeholders, especially those who will use the systems in their work. One result of designing systems incorporating the ETHICS method is to create jobs which are meaningful and fulfilling. ETHICS, although developed in the specific context of developing new organisational information systems, discusses the general principles of employee



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satisfaction and consultation that are important to any new system if it is to be successful. These same important principles were applied to an already built email system in trying to create the electronic monitoring guidelines. The employees were asked for their input in creating the guidelines, but it was found to be near impossible to provide guidelines that everyone agreed on.

As technology changes and evolves, novel unanticipated ways of acting are made possible (Neumann P.G. 1994). Some characteristics of IT include programmability, portability, simplicity, speed and easily hidden actions. Each of these characteristics alone does not distinguish IT from other technologies, but collectively the characteristics provide a unique quality to computers and IT that other technologies do not share.

The ongoing public debate on ownership and privacy makes it clear that they are not well understood (Brown B. 1994), (Dyson E. 1994), (Nelson C. 1994). Legal policies overwhelmingly support company monitoring (Oz E. 1994), yet the advocacy literature argues uniformly that computer-based company monitoring is wrong (George J.F. 1994). While the telephone and postal system favours individual rights, company rights seem to prevail within email systems. There is a requirement to have a clear understanding of the issues in order to come to a consensus on what is appropriate behaviour (Loch K.D., Conger S. and Oz E. 1998).

While professional organisations such as the Data Processing Management Association, the Association for Computing Machinery, the Canadian Information Processing Society and the British Computer Society have established ethical codes, they have failed to collaborate and formulate one set of uniformly defined guidelines (Oz E. 1992), (Oz E. 1994), (Anderson R.E. et al. 1993). The topics of email privacy in the workplace and rights over email content will continue to be highly controversial (Nelson C. 1994). Company monitoring is frequent. Pillar (1993) reported that about

30% of companies with over 1,000 employees engage in monitoring of computer files, voice mail, email or other communications.

With the current research falling short of creating guidelines for an electronic monitoring policy that also takes into account the ethical issues, the author as part of his research has formulated, through the use of the case studies, a set of guidelines. The guidelines are necessary as part of the author's research because the research required the electronic monitoring of the Danwood Group employees while they were using the email system. The Danwood Group already have a monitoring policy in place which was part of their staff handbook, but it falls short of bridging the gap between employees' and employer's interests on the issue of electronic monitoring. The research into the ethical issues of monitoring, and the author's guidelines on electronic monitoring, are discussed in Chapter 4.

### 2.3 Internal Email Costing Formulae

Little empirical research has been carried out into how email systems are used and the "hard" costs of running such a system in terms of the time an employee spends using the email facility. We still have much to learn about interactions among computer-mediated communication technologies, new organisational forms, and changes in work and communication (Daft R.L. and Lewin A.Y. 1993), but the ability to monitor email now provides organisations with the opportunity to improve communication practices. Email is becoming an integral part of the communication structure within organisations, but the costs and benefits are not being assessed. Communication is carried out in many different forms, but the common underlying motive of communication is to improve working practices and to increase employee effectiveness.

As companies struggle to shed excess costs and to respond more nimbly to customers and competitors, they are being urged to adopt new organisational forms and tighter



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inter-organisational linkages, and to improve management practices (Miles R.E. and Snow C.C 1986). To support these “network” forms of organisation, more and more firms, especially those that are geographically dispersed, are turning to electronic networks and advanced communication media, such as electronic mail (White K.B. 1986).

A problem is that technology often magnifies shortfalls in communication skills (Frazee V. 1996). Most are not taught how to be effective electronic communicators (Nantz K.S. and Drexel C.L. 1995) and a constant barrage of less-than-useful email messages disrupts workflow and robs employees of productive time (Frazee V. 1996). It has been revealed that more than 65% of all email messages failed to leave receivers enough information to enable them to act on the message (Frazee V. 1996). No company can afford such information incompetence (Davenport T.H. 1997) but, as many studies are discovering, email use is growing at an increasing rate. A study by EdWel & Company, a Chicago-based consulting and training firm, discovered that some individuals receive 80 to 100 email messages per day (Frazee V. 1996). Average email users were said to receive approximately 15 messages per day and spend almost 50 minutes merely reading those messages (Frazee V. 1996). Lynne Markus found in her survey that 22% of survey respondents reported sending between 0 and 5 messages per day, 53% reported sending between 6 and 30 email messages per day; and 25% reported sending more than 21 messages per day (Markus L.M. November 1994).

As part of the author’s research, the “hard” costs of using an email system, in terms of email interactivity instead of the cost of the software and hardware, are to be determined. As well as determining the “hard” costs, the author is to determine how employees are using the email system, for example how many emails does an employee receive a day and at what times do they send or receive email throughout the day? The findings from this research will lead to a better understanding of how an email system is used within an organisation and how it can be optimised to help employees to become more cost effective.

## 2.4 One-Line Emails

As the popularity of electronic mail has grown, so has the number of messages sent and received by its users (Sproull L. and Kiesler S. 1991), (Markus L.M. November 1994). The number of email messages is expected to increase even more over the next several years (Rudy I.A. 1996). Due to the large amount of mail received, there is now substantial attention being paid to methods for increasing the efficiency of processing and organising messages. One of the methods receiving attention is the structured response object. Structured response objects, as shown by Figure 2.1, can include buttons, menus, formatted fields and other objects that the sender can include in the body of the message and that can trigger a variety of functions when manipulated by the recipient (Camino B. M. et al. 1998). Several commercial email systems (e.g. Lotus Notes and Microsoft Exchange) allow the sender to specify a form that recipients can fill out, thus imposing a structured reply. In addition, computational email prototypes that can embed capabilities, including form rendering, within a message, also give structured responses (Lai K. -Y., Malone T.W. and Yu K. 1998), (Borenstein N. 1992). An example of this would be an email which contained drop-down combo boxes, one labelled “department” and the other “location”. Once a department had been selected the “location” combo box would then recalculate its contents and only display valid locations for where the selected department could be situated.

There are reports that in some organisation-wide situations, the use of structured response objects can result in real efficiencies (Gates 1995). They can reduce the amount of time and effort spent by the recipient while responding to the message. In many structured response cases, the recipient can simply click the mouse once and the message is answered in a meaningful way as shown by Figure 2.1. Also, because structured responding can enforce more consistency in the reply content, these objects can help the sender and recipient to organise, filter and potentially perform automatic processing on the replies.



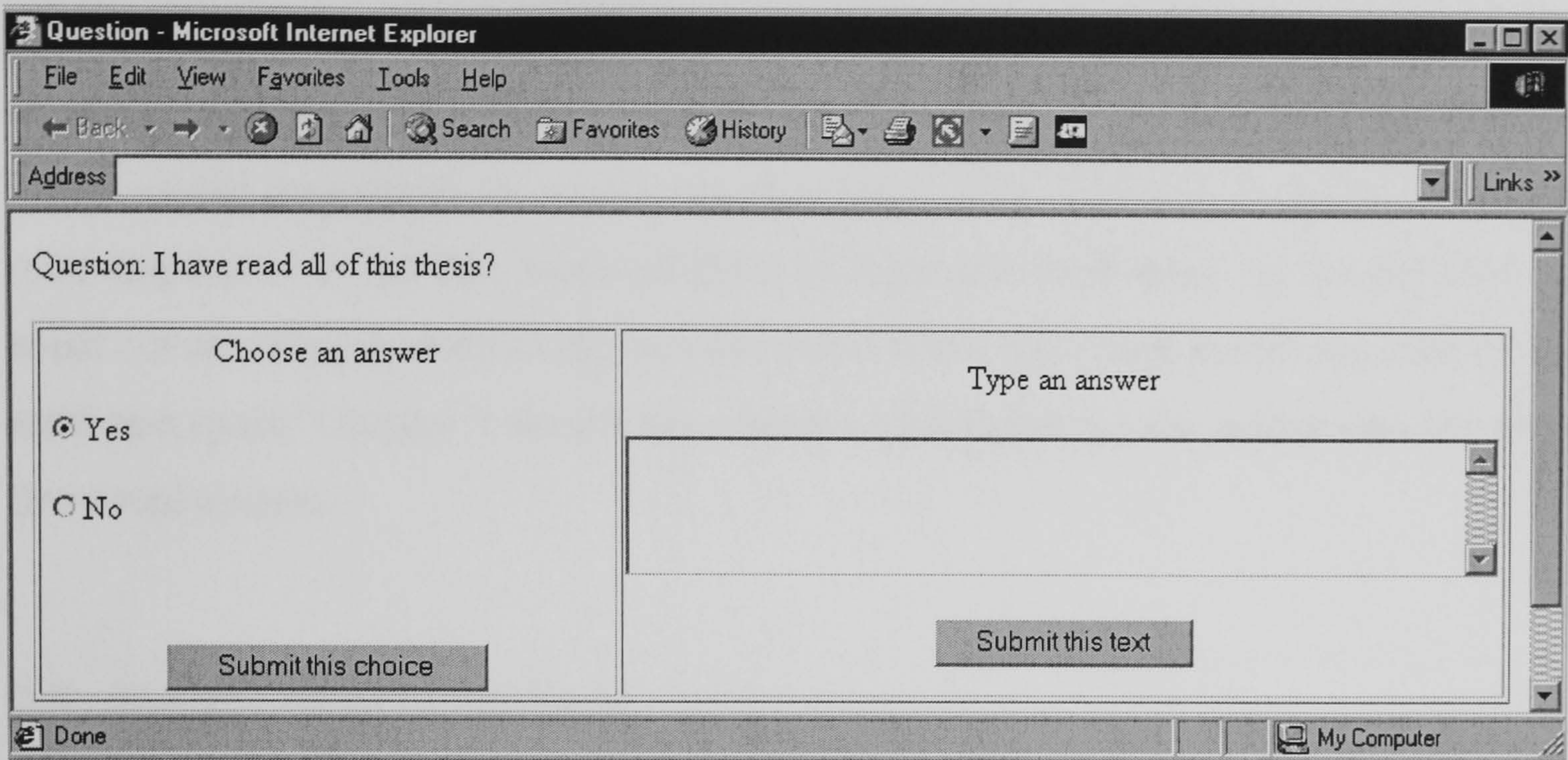


Figure 2.1 – Structured response object

By prespecifying appropriate responses, some of the communication burden typically assumed by responding (i.e. recipients who respond to a message) is shifted to the sender of the message, perhaps lowering the barrier to response by the recipient. In return, the sender can realise increased efficiency through automatic collection and analysis of responses. Furthermore, automatic reply processing may help decrease the number of reply messages in the sender’s mailbox, thus providing a task-management advantage for those who use their email inbox as a rolling “to-do” list (Whittaker S. and Sidner C. 1996).

The problem with structured response objects has to do with their “richness” as media elements. The perceived social richness of a medium can determine how often and for what kinds of messages it is used (Trevino L., Daft R. and Lengel R. 1987), (Kydd C. and Ferry D. 1995). Although email itself can be judged as surprisingly rich (Trevino L. et al. 1990), structured response objects might be perceived as less personal or more formal and distant than full-text communication, which may reduce its usage.

With the widespread use of email, along with the account of unsuccessful returns on technology investments, one might begin to question why training in electronic



communication skills is not included in employee training packages today. After the research into the internal email costing formula, the data highlighted that the majority of emails could be written in just one line. It was decided to create an email add-on that would enable employees to write a one-line email. The application was built to help train employees to become more effective in their communication by saving time on email communication and forcing them to create better structured emails because of the restricted space. Chapter 7 details the research undertaken by the author into the one-line email system.

## 2.5 Email Usage Guidelines

The email usage guidelines have been constructed through monitoring employees while they were using the email system. In particular, detailed research has been carried out to determine if there is such a phenomenon as an interrupt recovery time for email and, if there is, to discover if there is a “hard” cost associated with an email interruption. Research carried out by Solingen into communication interrupts showed 15-20 percent of an employee’s effort is spent dealing with interrupts and in real terms 15-20 minutes per interrupt (Solingen R., Berghout E. and Latum F. September/October 1998). An interrupt is defined as “any distraction that makes a developer stop his planned activity to respond to the interrupt’s initiator”. There were three types of interrupts defined: personal visits, telephone calls and emails. Personal visits and telephone calls caused 90 percent of all interrupts and email caused the rest. The results showed the effort spent on interrupts required approximately 20 minutes for each occurrence, including the time spent handling the interrupt, and that the average developer receives three to five interrupts per day. This consumes roughly 1 to 1.5 hours per day of the developer’s time. DeMarco reported that the recovery time after a phone call interruption is at least 15 minutes, thus increasing the amount of time spent on interrupts a day (DeMarco T. and Lister T. 1987). However, DeMarco’s research was carried out using software developers as the subjects. The highly creative nature of a software developer’s job means they are likely to require extra time to recover from

an interrupt compared to other job roles, hence the 15 minutes recovery time. This is because the nature of a developer's work is likely to be quite complex and to require careful thought in order to pick up where they had left off. So far, there has been no reported empirical research into how long it takes to recover from an email interrupt. This could be because of the perception of email as causing a minimal interrupt. DeMarco suggests that the only difference between a phone call and an electronic mail message is that the phone call interrupts and the email does not, as recipients deal with emails at their own convenience (DeMarco T. and Lister T. 1999).

Research on the effects of interrupts started in the late 1920s, when Zeigarnik (1927) and Ovsiankina (1928) studied the effects of completed versus uncompleted physical and mental tasks on memory. In her experiments, Zeigarnik (1927) asked subjects to execute a series of mental (arithmetic) and motor (drawing, constructing) tasks. During some of the tasks, the subjects were interrupted by giving them the material of the next task. When the subjects had to recount which tasks they had executed, it was found that the interrupted tasks were remembered better than the non-interrupted tasks. This effect was later called "the Zeigarnik effect". One explanation for this effect was the existence of a so-called "quasi-need" (Lewin, 1935). This need arises when the individual has the intention to perform and complete a task, thus evoking a tension or energy state. This tension decreases only when the goal of the task has been achieved. Gestalt theorists also explained the Zeigarnik effect (Psychological Schools of Thought. 1998). These theorists provided the idea of grouping principles of, for instance, proximity, similarity, continuity etc. In particular, the principle of closure was considered to be important. Closure can be described as the tendency towards completing a task or problem in order to achieve an organised and coherent field, led by forces which hold it together. The need for closure leads to an increase in effort and better memory of the interrupted task than of the uninterrupted task (Schiffman N. and Greist-Bousquet S. 1992).



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Between the 1930s and the late 1960s, numerous experiments were conducted to gather more information on variables influencing the Zeigarnik effect, such as age, motivation, speed of recall, personality etc. Some of these experiments confirmed the Zeigarnik effect, while other experiments did not. After an extensive review of all related experiments, Van Bergen (1968) concluded that the endorsements of the original results were weak. Cultural differences, influences of fatigue and anxiety (Atkinson J.W. 1953), performance attitudes (Van Bergen A. 1968), as well as the types of tasks (for example complexity, (Glixman A.F. 1949), (Caron A.J. and Wallach M.A. 1957), 1957, (Van Bergen A. 1968)) were indicated as causes of some of the contradictory results in replication studies.

More recently, work-related interruption research has focused on the influence of noise on performance (Broadbent D.E. 1979), the effects of interruptions in terms of technical problems and errors in industrial production (Hartley L. R., Morrison D. and Arnold P. 1973), (Rasmussen J. 1986) and the effects of computer breakdowns, rest breaks etc. on performance (Johansson G. and Aronsson G. 1984), (Boucsein W. 1989), (Boucsein W. 1993), (Henning R.A. et al. 1989). An important difference between the older (before 1970) and the more recent investigations is that interruptions were used as a technique for studying psychological factors such as motivation. In later studies, interruptions are more or less treated as a phenomenon in themselves.

Apart from having effects on work outcomes, interruptions can also affect the personal state, in particular the emotions of the worker. Already in 1928, Ovsiankina mentioned the existence of negative emotions as a result of interruptions as subjects felt irritated. Mandler, first in 1964 and later in 1975 and 1984, formulated the relation between interruptions and emotions in more detail. He believed that another phenomenon is involved in the interruption process, besides the tendency to complete, namely, an emotional response. This response can direct workers' behaviour and it does not emerge unless an organised response has been interrupted. So far, no study has yet

addressed the issue of emotions in interrupted work, although some researchers have acknowledged its importance (Briner R.B. 1995), (Pekrun R. and Frese M. 1992).

Research into interrupt recovery times for email interrupts is covered in Chapter 8. The research has enabled detailed email usage guidelines to be created taking into account the effect of interrupts on employees. The findings in Chapter 8 have also given more substance to the “hard cost values” of the internal email costing formula.

## 2.6 Summary

This chapter has reviewed and summarised email research work covering both “soft cost values” and “hard cost values”. There has been little research into the four main research areas defined by the author. However, the literature covered in this chapter is of great importance to the thesis as a whole in that it sets the scene for the research methodology that follows in the next chapter.

## CHAPTER 3 - METHODOLOGY

### Chapter Preface

The way in which research is conducted may be conceived in terms of the research philosophy subscribed to and the research strategy employed in the pursuit of the research objectives and the quest for the solution to the research question. The research question and research objectives have been outlined in Chapter 1. The purpose of this chapter is to:

- discuss the research philosophy in relation to other philosophies, and
- explain the research strategy, including the research methodologies adopted.

### Chapter Keywords

Interpretivist, Idiographic, Case Studies

### 3.1 Research Philosophy

A research philosophy is a belief about the way in which data about a phenomenon should be gathered, analysed and used. The term epistemology (what is known to be true) as opposed to doxology (what is believed to be true) encompasses the various philosophies of research approach. The purpose of science, then, is the process of transforming things *believed* into things *known*: doxa to episteme. Two major research philosophies have been identified in the tradition of science, namely positivist (sometimes called scientific) and interpretivist (also known as anti-positivist)(Galliers, 1992).

#### 3.1.1 Positivism

Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Levin WC. 1988), i.e. without interfering with the phenomena



being studied. They contend that phenomena should be isolated and that observations should be repeatable. This often involves manipulation of reality with variations in only a single independent variable so as to identify regularities in, and to form relationships between, some of the constituent elements of the social world. Predictions can be made on the basis of the previously observed and explained realities and their inter-relationships. Positivism has also had a particularly successful association with the physical and natural sciences.

There has, however, been much debate on the issue of whether or not this positivist paradigm is entirely suitable for the social sciences (Hirschheim RA. 1985), many authors calling for a more pluralistic attitude towards Information Systems research methodologies (Kuhn TS. 1970), (Bjørn-Andersen N. 1985), (Remenyi D. and Williams B. 1996). Indeed, some of the difficulties experienced in IS research, such as the apparent inconsistency of results, may be attributed to the inappropriateness of the positivist paradigm for the domain. Likewise, some variables or constituent parts of reality might have been previously thought unmeasurable under the positivist paradigm, and hence went unresearched (Galliers Robert, 1992).

### *3.1.2 Interpretivism*

Interpretivists contend that only through the subjective interpretation of and intervention in reality can reality be fully understood. The study of phenomena in their natural environment is key to the interpretivist philosophy, together with the acknowledgement that scientists cannot avoid affecting those phenomena they study. They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are pursuing.

### 3.1.3 *Discussion and Rationale for Choice of Approach*

Both research traditions start in classical Greek times with Plato and Aristotle (positivists) on the one hand, and the Sophists (anti-positivists) on the other. Well known positivists have included Bacon, Descartes, Mill, Durkheim, Russell and Popper. On the opposing side there are Kant, Hegel, Marx, Freud, Polanyi and Kuhn (Hirschheim RA. 1985).

Vreede (1995) observes that, in both organisation science and information systems research, interpretive research used to be the norm, at least until the late 1970s. Since that time, however, the positivist tradition has taken a firm hold (Dickson GW. and DeSanctis GL. 1990), Orlikowski and Baroudi (1991) noting that 96.8% of research in the leading US IS journals conform to this theory. It has often been observed (e.g. Benbasat I.G., Goldstein D.K. and Mead M. 1987) very accurately that no single research methodology is intrinsically better than any other methodology, many authors calling for a combination of research methods in order to improve the quality of research (e.g. Kaplan B. and Duchon D. 1988). Equally, some institutions have tended to adopt a certain "house style" methodology (Galliers Robert, 1992); this seems to be almost in defiance of the fact that, given the richness and complexity of the real world, a methodology best suited to the problem under consideration, as well as the objectives of the researcher, should be chosen (Benbasat I.G. 1984), (Pervan G.P. 1994).

The author's overriding concern is that the research undertaken should be relevant to the research question, as set out in Chapter 1. The author has chosen the interpretivist philosophy, which seems appropriate for this purpose, i.e. the understanding of how employees adopt and adapt to the use of Information Systems, specifically email systems. The author's research is concerned with capturing information from a social environment rather than from a laboratory in a scientific approach, which leads the author to select the interpretivist philosophy rather than the positivist philosophy. The author's research involves an element of technology transfer, insofar as the email system was not previously installed in the Danwood Group. This requires that the

author play a part in the implementation process. Furthermore, in order to measure how the Danwood Group can improve their email effectiveness, the author has made recommendations for use of the email system after analysing existing usage habits.

### 3.2 Research Approach

There are many different combinations of research approaches that could have been adopted and used as a framework to undertake the planned research experiments. The author has considered three broad styles of research approach. The three approaches are as follows.

1. Constructive research methods
  - conceptual development
  - technical development
2. Nomethetic research methods
  - formal-mathematical analysis
  - experiments, laboratory and field
  - field studies and surveys
3. Idiographic research methods
  - case studies
  - action research

The constructive approach is concerned with developing frameworks, refining concepts or pursuing technical developments. The approach allows models and frameworks to be created that do not describe any existing reality or do not necessarily have any “physical” realisation (Cornford and Smithson 1996). With all of the author’s planned research to be carried out in a social environment there is no requirement to create an artificial framework to capture the data.



Nomothetic research is concerned with exploring empirical data in order to test hypotheses of a general character about phenomena studied. Nomothetic research is concerned with a search for, and evidence to support, general laws or theories that will cover a whole class of cases. Such research emphasises systematic protocols and hypothesis testing within the scientific tradition. However, as already discussed within this chapter, the author’s research is more concerned with the interpretivist approach, which closely links to social environments (Cornford and Smithson 1996).

In contrast to the constructive and nomothetic approaches, idiographic research is concerned with exploring particular cases or events and providing the richest picture of what transpires. The aim is to understand a phenomenon in its own, particular, context. Idiographic research emphasizes the analysis of subjective accounts based on participation or close association with everyday events. Within information systems there is a strong tradition of case studies, which might be seen as examples of idiographic research. In the case of the author’s proposed research, case studies are likely to play a major role due to their non-restrictive variable approach, which means that the idiographic approach is the most suitable framework for the author’s research (Cornford and Smithson 1996). However, with the research approach decided, the different kinds of methodologies need to be considered to form a research strategy.

3.3 Research Strategy

A large number of research methodologies have been identified, Galliers (1992) for example listing fourteen, while Alavi and Carlson (1992), reported in Pervan (1994b), use a hierarchical taxonomy with three levels and eighteen categories. Table 3.1 presents a list of methodologies identified by Galliers (1992, p.149), indicating whether they typically conform to the positivist or interpretivist paradigms. Table 3.1 also shows, indicated by ticks, the research approach the author intends to use for his research. Before introducing the methodologies used in this research, the author will summarise the key features of the key methodologies in the table, identifying their

respective strengths and weaknesses. In the following sections, the author will justify the choice of methodologies and explain how they operate.

Scientific/Positivist		Interpretivist/Anti-positivist	
Laboratory Experiments		Subjective/Argumentative	
Field Experiments		Reviews	
Surveys	✓	Action Research	
Case Studies		Case Studies	✓
Theorem Proof		Descriptive/Interpretive	
Forecasting		Futures Research	
Simulation		Role/Game Playing	

Table 3.1 – A Taxonomy of Research Methodologies

Laboratory experiments permit the researcher to identify precise relationships between a small number of variables that are studied intensively via a designed laboratory situation using quantitative analytical techniques with a view to making generalisable statements applicable to real-life situations. The key weakness of laboratory experiments is the "limited extent to which identified relationships exist in the real world due to oversimplification of the experimental situation and the isolation of such situations from most of the variables that are found in the real world" (Galliers, 1992, p.150).

Field experiments extend laboratory experiments into real organisations and their real life situations, thereby achieving greater realism and diminishing the extent to which situations can be criticised as contrived. In practice it is difficult to identify organisations that are prepared to be experimented on and still more difficult to achieve sufficient control to make replication viable.

Surveys enable the researcher to obtain data about practices, situations or views at one point in time through questionnaires or interviews. Quantitative analytical techniques are then used to draw inferences from this data regarding existing relationships. The use of surveys permits a researcher to study more variables at one time than is typically



possible in laboratory or field experiments, whilst data can be collected about real world environments. A key weakness is that it is very difficult to realise insights relating to the causes of or processes involved in the phenomena measured. There are, in addition, several sources of bias such as the possibly self-selecting nature of respondents, the point in time when the survey is conducted and in the researcher him/herself through the design of the survey itself.

Case studies involve an attempt to describe relationships that exist in reality, very often in a single organisation. Case studies may be positivist or interpretivist in nature, depending on the approach of the researcher, the data collected and the analytical techniques employed. Reality can be captured in greater detail by an observer-researcher, with the analysis of more variables than is typically possible in experimental and survey research. Case studies can be considered weak as they are typically restricted to a single organisation, and it is difficult to generalise findings since it is hard to find similar cases with similar data that can be analysed in a statistically meaningful way. Furthermore, different researchers may have different interpretations of the same data, thus adding research bias into the equation.

Simulation involves copying the behaviour of a system. Simulation is used in situations where it would be difficult normally to solve problems analytically, and it typically involves the introduction of random variables. As with experimental forms of research, it is difficult to make a simulation sufficiently realistic so that it resembles real world events.

Forecasting/futures research involves the use of techniques such as regression analysis and time series analysis to make predictions about likely future events. It is a useful form of research in that it attempts to cope with the rapid changes that are taking place in IT and to predict the impacts of these changes on individuals, organisations or society. However, it is a method that is fraught with difficulties relating to the complexity of real-world events, the arbitrary nature of future changes and the lack of



knowledge about the future. Researchers cannot build true visions of the future, but only scenarios of possible futures.

Subjective/argumentative research, for example hermeneutics and phenomenology, requires the researcher to adopt a creative or speculative stance rather than act as an observer. It is a useful technique since new theories can be built, and new ideas can be generated and subsequently tested. However, as an unstructured and subjective form of research, there is a strong chance of researcher bias.

Action research is a form of applied research where the researcher attempts to develop results or a solution that is of practical value to the people with whom the researcher is working, at the same time developing theoretical knowledge. Through direct intervention in problems, the researcher aims to create practical outcomes while also aiming to reinform existing theory in the domain studied. As with case studies, action research is usually restricted to a single organisation, making it difficult to generalise findings, while different researchers may interpret events differently. The personal ethics of the researcher are critical, since the opportunity for direct researcher intervention is always present. A summary of the different research approaches has been given in Table 3.2.

Approach	Key Features	Strengths	Weaknesses
Laboratory Experiments	Identification of precise relationships between chosen variables via a designed laboratory situation, using quantitative analytical techniques, with a view to making general statements applicable to real-life situations	The solutions and control of a small number of variables which may then be studies intensively	The limited extent to which identified relationships exist in the real world due to oversimplification of the experimental situation and the isolation of such situations from most of the variables that are found in the real world.

Field Experiments	Extension of laboratory experiments into the real-life situations of organisations and/or society.	Greater realism; less artificial/sanitised than laboratory situation	Finding organisations prepared to be experimented on. Achieving sufficient control to enable replication, with only the study variables being altered
Surveys	Obtaining snapshots of practices, situations or views at a particular point in time (via questionnaires or interviews) from which inferences are made (using quantitative analytical techniques) regarding the relationships that exist in the past, present and future.	Greater number of variables may be studied than in the case of experimental approaches. Descriptions of real world situations. More easy / appropriate generalisations.	Likely that little insight is obtained re the causes/processes behind the phenomena being studied. Possible bias in respondents.
Case Studies	An attempt at describing the relationships which exist in reality, usually within a single organisation or organisational grouping.	Capturing ‘reality’ in greater detail and analysing more variables than is possible using any of the above approaches	Restriction to a single event / organisation. Difficulty in generalising, given problems of acquiring similar data from a statistically meaningful number of cases. Lack of control variables. Different interpretations of events by individual researchers.
Simulation	An attempt at copying the behaviour of a system which would otherwise be difficult/impossible to solve analytically, by the generation/introduction of	Provision of an opportunity to study situations that might otherwise be impossible to analyse.	Similar to experimental research in regard to the difficulties associated with devising a simulation that accurately reflects the real world situations.

	random variables.		
Subjective argumentative research	Creative research based more on opinion / speculation than observation.	Useful in building theory that can be subsequently be tested.	Unstructured, subjective nature of research process. A likelihood of biased interpretations.
Forecasting/futures research	Use of such techniques as regression analysis and time series analysis to deduce possible events	Provision of insights into likely future occurrences in situations where existing relationships may not hold true in the future.	Complexity and changing relationship of variables under study. Lack of real knowledge of future events.

Table 3.2 – A summary of the key features, strengths and weaknesses of alternative information systems research approaches (Galliers Robert, 1992)

The author as part of his research is going to use the case study approach, which has been defined below along with the justification for using the approach for his research.

3.3.1 Case Study Research

There are a number of important articles describing the case study approach to research. Key among these is Benbasat et al.'s (1987) paper with its comprehensive definitions and suggestions for the conduct of case research. The case study is considered by Benbasat et al. (1987, p.370) to be viable for three reasons.

- It is necessary to study the phenomenon in its natural setting.
- The researcher can ask "how" and "why" questions, so as to understand the nature and complexity of the processes taking place.



- 
- Research is being conducted in an area where few, if any, previous studies have been undertaken.

Case studies are defined in various ways, and a standard does not exist. However, a definition compiled from a number of sources (Stone E. 1978), (Benbasat I.G. 1984), (Yin R.K. 1984), (Bonoma T.V. 1985) and (Kaplan R.S. 1985) in Benbasat et al. (1987, p.370), is as follows.

- A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organisations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used.

When deciding whether to use the case study approach or not, there are a number of factors to consider. If there is a need to focus on contemporary events or phenomena in a natural setting, clearly the case study is advantageous. The same is also true if there is no strong theoretical base for the research, i.e. if it is a theory building research project. “A rich and natural setting can be fertile ground for generating theories” (Benbasat I.G., Goldstein D.K. and Mead M. 1987). However, if there were a need for control or manipulation of variables, then the case study would not be appropriate. It is important to clarify the need that should relate to the nature of the problem rather than the inability of the researcher to undertake research with a particular methodology. Within the case study approach there are a number of variations. A key feature of the design of case study research is the number of case studies that can be included in a project. Generally speaking it is better, i.e. more valid and generalisable, to include multiple cases, though there are instances where a single case is instructive (see e.g. (Lee A.S. 1989). Exploratory studies are generally better served by single cases, i.e. where there is no previous theory. A single case can also be used to test an existing, well-formed theory. Multiple cases are preferable when the purpose of the research is to describe

phenomena, and to develop and test theories. Multiple cases also permit cross-case analysis, a necessary feature for widespread generalisation of theories. The sites or locations where cases are to be conducted should be chosen with great care. As has already been indicated, case studies require multiple data collection methods, the results of which hopefully converge, in order to establish construct validity. Yin (1984, p.78) identifies these methods as including:

- direct observation of activities and phenomena and their environment;
- indirect observation or measurement of process-related phenomena;
- interviews –(structured or unstructured);
- documentation, such as written, printed or electronic information about the company and its operations (also newspaper cuttings);
- records and charts about previous use of technology relevant to the case.

The case study approach is the most suitable for the author's research as it can address the implementation of a new email system in the Danwood Group over a period of time. It is also useful for topics and areas of study, like an email system, which are novel or which have little theory as yet. The case study approach will help build the author's theories in a relatively new area of research.

### 3.4 Summary

This chapter has presented a detailed account of the research philosophy, approach and strategy according to which the research has been conducted. The author has placed the research in the interpretivist camp, utilising a mixture of survey and case study research approaches. As the author only intends to use multiple case studies incorporating surveys, which is a more an interpretivist approach, the framework to be used for the research is an idiographic one, due to the “real life” Danwood Group environment. Finally, the research strategy has been determined by using previous literature describing case studies, which has been valuable in identifying the most important



points of the case study methodology, as well as illustrating the weaknesses associated with earlier research.

## CHAPTER 4 - THE ETHICS OF E-MONITORING THE WORKPLACE

### **Chapter Preface**

This chapter is based on the “The Ethics of Electronic Monitoring within the Workplace” paper, which was presented at the Software Quality Management conference in April 2001 (Jackson T.W. et al. 2001). Nilpa Shah, a PhD student at Loughborough University, also helped to create the paper. This chapter shows that electronic monitoring of employees’ use of email and the World Wide Web can be beneficial to a company and even to its employees. However, the use of monitoring and the resulting intrusion into personal privacy can also have adverse effects. Ideally, monitoring should only be used to increase the efficiency of the organisation. This would lead to a far more relaxed attitude to monitoring within the work place. It is difficult for companies to obtain the right balance between private and work-related Internet use. A solution to this problem is to contract an independent outside party to undertake the monitoring process.

The chapter concludes with suggested guidelines for establishing an agreed electronic monitoring policy which should enable increased employee effectiveness from better use of electronic facilities yet still be acceptable to employees. The greater acceptability of independent monitoring and the more relaxed atmosphere of a not-too-restrictive policy on email and Internet use will increase the overall company morale which, in turn, will produce a happier, more effective environment that will benefit both employees and managers alike.

### **Chapter Keywords**

Ethics, Monitoring, Workplace



## 4.1 Introduction

Monitoring takes place everywhere, from the street corner with the use of closed-circuit television (CCTV), to the office environment. The digital age has brought about a greater significance of monitoring, with the introduction of the ability to record in detail the events that have taken place. Through the use of the Internet and email, these events can be disseminated within minutes around the world. There are a number of examples that show the strength of both these communication media. Firstly, there is an Internet site that allows you to watch CCTV cameras on-line in various locations throughout the world (Khiroug 1999). Secondly, the power of email was recently demonstrated through the global distribution of the “I Love You” virus, which has caused multimillion-pound damages to organisations (Ticehurst 2000).

Monitoring of staff is not new, and until the advent of automated telephone systems company switchboard operators would often check on the first few moments of a phone conversation. Modern communication systems provide information which streams in and out of businesses at the click of a mouse and it is important for an employer to have some control of the information in case of any litigation against them (BBC News On-Line 2000a). It is the extent to which an employer will go to monitor employees that may cause unrest within the workplace. According to a 1995 study, most people are “not aware of their employers’ legal right to read and monitor their email messages. Only 26% thought that email monitoring is legal when no monitoring policy exists, while 47% considered it to be legal when a company has an email monitoring policy” (Cappel James J. 1995 October).

The invasion of privacy is probably the most feared event at home and at work. No one likes to have their house burgled and their belongings rooted through, and employees don’t like their personal computers at work to be hacked into or monitored by their employers. New regulations giving employers sweeping powers to monitor their workers' emails and Internet activity came into force in the UK in October 2000.

When the UK Government first proposed new regulations, the business community complained that they were far too restrictive. After fierce lobbying, employers were given wider powers and the unions warned that privacy was under threat, but Government claims the new regulations are aimed at allowing businesses to get the most out of the new communication technologies. Under the new Regulation of Investigatory Powers Act, employers can legally monitor employee phone calls, emails and Internet activity without consent, for a wide range of reasons (BBC News On-Line 2000a), (Ward Mark. 2000).

The government suggests employers must strike a balance between privacy and surveillance. The problem will be in balancing the privacy rights of the individual with the rights of an employer legitimately to investigate potential wrongdoing by an employee. Through the use of case studies the chapter shows how this balance can be achieved between employers and employees. It will also show how organisations can lose efficiency within their workplace if employers do not monitor their employees' communication activities, but how monitoring without good cause will turn employees against their employer.

## 4.2 The E-Monitoring Perception within the Workplace

To a majority of employees within the workplace monitoring their activities is not acceptable. Before any recommendation can be made to bridge the monitoring gap between employers and employees, it is important fully to understand the concerns of the workers as well as those of the employers. The difficulty for the employees is to determine where monitoring will end and, if they do not make a stand now, whether their human rights will slowly start to disappear. In a recent BBC News online report (BBC News On-Line 2000b), a number of opinions were taken from employees on how they felt about being monitored in the workplace.



“It's incredibly small-minded to spend time and money monitoring people's emails and web usage at work. People should be positively and actively encouraged to use the Net for email and surfing. If you don't you are simply restricting your employees' growth. Taking the view people are simply in an office to work is blinkered and reduces what they can offer to their workplace.”

“E-mail should be treated exactly as if it was Royal Mail. I do not expect my employer to open up my personal letters posted to me at my house. One could also view e-mail rather like a conversation you might have with a friend or colleague. I have been verbally abused in the pub, I can also give as good as I get. But I do not expect to have some nasty little man sitting next to me writing everything down in case I offend him or because he doesn't like dirty jokes. We really are on the way to (or is it back to) 1984. ”

The types of opinions from the employees surveyed were typically anti-monitoring, which was to be expected. It is difficult for many employees to see why it is necessary to be monitored, and the response from the employers that it is to help prevent any litigation against the company is not seen to be true by the employees. This is mainly due to a number of articles and reports in the news, covering employees being sacked through misuse of the email and Internet systems. One of these cases is highlighted below.

A large printing company based in the East Midlands in the UK recently sacked the whole IT department for misuse of the email system and company time. The employees were sacked after monitoring highlighted that some workers might have been carrying out work in competition with the company. A few weeks after the sackings an ulterior motive emerged when a number of staff were taken back as contractors after the company's likely merger with their sister company in London, which already had an IT department, fell through.



For the employees being monitored there is little benefit in using the email and Internet systems put into place by the company, as potentially, through their use, the employees could lose their jobs. This type of thinking by the employee is potentially damaging for the company and will hinder employee effectiveness if lines of communication are restricted through being monitored.

There are of course two sides to the employee effectiveness argument and the second is from the employer's point of view. If employees are not monitored this could lead to a loss in employee effectiveness as there is nothing to stop employees surfing the Internet and writing non-business emails all day. In July this year a survey of Canadian workers estimated that up to 800 million work hours will be lost in Canada this year because workers are surfing for themselves on company time (Ward Mark. 2000). Many workers abuse systems in other ways. In September, Orange sacked 45 people who had been downloading and distributing pornography in company time (Ward Mark. 2000). This is not surprising as 70% of all Internet porn traffic occurs during the 9-to-5 workday (SexTracker 2000). It is made clearer to the employer, with workers spending an average of 21 hours online at the office per month compared to an average of 9.5 hours at home, that monitoring must play a part within the office environment (Nielsen 2000).

### 4.3 The Effects of Monitoring the Workplace

In an early, 1927-1933, productivity study in Western Electric's Hawthorne plant near Chicago researchers discovered that their own presence affected the outcome of the research. In determining the effects of various environmental parameters on productivity, the researchers tried raising the light level, and they noted that the productivity went up. Then they tried lowering the light level, and they noted that productivity went up higher still. In this case, so long as the study was in progress, productivity increased. The term "Hawthorne Effect" was coined to define the

influence of the researchers' presence on the outcome of the study, which was that their attention to the employees increased employee productivity (Mayo E. 1933).

If employee productivity increases through monitoring, then employers have a legitimate case to monitor, as it will enhance the company's performance as shown by the Hawthorne Effect. Gina Kolata dismissed the effect in the New York Times with the article titled "Scientific myths that are too good to die" (Kolata 1988). Apparently only five workers took part in the original study, and two were replaced before the study was finished. Adair, Sharpe, and Huynh examined 86 studies, which used control groups and concluded that there is no such thing as the Hawthorne Effect and, if there is, it is too small to be of importance, since the 86 studies did not find it.

It is not difficult to envisage conditions that could cause the Hawthorne Effect, particularly back in 1933. If a collection of smart-looking researchers were seen to be constantly monitoring the work and regularly recording the productivity of the workers this could have one of two different effects. Firstly, they may have felt they were getting attention and that someone actually cared about how well they were doing. This could improve morale and in turn increase productivity. Alternatively, the employees could have felt uncomfortable and resented being watched closely, and this could have had a detrimental effect on morale and productivity. Whether beneficial or detrimental, the important point is that monitoring of employees can have some effect as the author's research described below shows.

Early research carried out at the head office of the Danwood Group at Lincoln in the UK (Jackson T.W., Dawson R. and Wilson D. 1999) showed that the employees' performances changed when they thought they were being monitored. At the time of the research, the Danwood Group had no specific email policies to restrict their employees. Towards the end of the three-month experiment, the author disclosed to one of the Danwood employees that the subject line of their emails was being recorded for research purposes. In order to record the metrics a special email application, "The



Danwood Mail”, was written by the author to analyse the users’ activities while using the package for communication. More in-depth detail about how the program was created is given in Chapter 5. The program recorded more than just the subject line and actually recorded:

- how many words were in a message,
- how long it took the user to read or compose the email,
- the subject of the message as well as the subject line,
- the recipient,
- the author,
- the time and date the email was sent.

After the information had been disclosed to the employee about the subject line being monitored, the employee must have told other employees within the company, as the employees using the email application began leaving the subject line blank. In some cases the subject line was only left blank when the email was non-business related. Monitoring clearly influenced the employees in making them find ways of disguising their activities. This is likely to have introduced yet further distraction from their normal work.

#### 4.4 The Effects of the Internet on the Workplace

In trying to produce guidelines for electronic monitoring in the workplace it is vitally important that the Internet is also taken into consideration to ensure a comprehensive set of guidelines. With people working the equivalent of a month or more per year in excess of the amount they worked a decade ago, and often taking work home, the lines between work and private life are becoming blurred. Now that work has invaded the home, it is only reasonable that a little of home life should be allowed to invade work. Use of the Internet is one area where many employees will undertake activities related to their private life in working hours using their employer’s equipment. The level of such activity has concerned some companies who have attempted to prevent or restrict



such use of the Internet. This, however, can have an adverse affect on employee morale. How committed is a person going to be to an organisation which effectively says, "I don't trust you?". How will productivity be affected once companies start blocking Internet access? It will reduce unnecessary use of the Internet, but how will employees react to being restricted, and will it affect their attitude to work?

Some employees are fighting back by encrypting their email messages and installing games that have panic buttons that pop up a fake spreadsheet if the boss strolls by. The discontented set relates the corporate watchdog activities to the suspicions that surfaced with the advent of the telephone a century ago and fax machines 15 years ago. Executives in both eras feared the new technology would lead to a leaking of trade secrets and decreased productivity.

While the Internet has obviously altered the face of computing, the effects on worker productivity are not so clear. Are workers spending too much time on the Internet hunting down the perfect vacation spot when they should be devoting their time to their work? Alternatively, could freely available connection time actually be an advantage to a company? Employees may find goods and services advertised on the Internet that would be of benefit to their company, or they could detect information on competitors that their company would benefit from knowing.

The Internet can be seen as a double-edged sword, capable of boosting employee effectiveness or of distracting employees away from productive work. Faced with this uncertainty, and a perceived threat, many companies are taking a cautious approach and are opting to restrict Internet access.

Statistics show that people use the Internet at work more than at home; what they are doing, however, is unknown (Emarketer 2000). They could be communicating with customers, investigating a competitor or profiling prospective suppliers. Alternatively they could be checking the weather or their personal stock portfolio, downloading

Disney film clips for the kids, or emailing résumés to employers advertising new job prospects.

There is no question that companies are very interested in finding out what their employees are doing on the Internet, and many are looking for ways to block access to certain sites. For some companies, as long as the work is getting done and they do not see a drop in productivity, they really do not care what employees are doing with the Internet connection. How much more could employees accomplish if they were not playing on the Internet? Even for very relaxed, creative environments, using current employers' Internet connections to look for new jobs could be considered unacceptable. For this reason more and more businesses are preparing detailed usage guidelines to inform employees about what they can and cannot do with corporate Internet connections (Itay Hod. 2000).

When Internet filtering software first became available in 1995, it was parents and schools who became the first users. However, now it is the CEOs (Chief Executive Officer) of large corporations spending lots of money to block employees' access to countless web sites (Itay Hod. 2000). It is not only the distraction of the time spent on the Internet that these companies are worried about, but also the nature of their employees' use of the web. Companies may object to gambling, music or pornography sites which they would not wish to be associated with (Itay Hod. 2000).

If employees are monitored while they surf on the Internet, it might lead to a slow-down of e-commerce and reduce Internet sales in general. Although restricting employees' access to the World Wide Web would not necessarily affect a company's own sales over the Internet, if many companies introduce the same restrictions then collectively it will affect the e-commerce economy. One of the knock-on effects may be on the British government, which will not be able to achieve its goal of making the UK the leading nation for e-commerce (UK Online. 2001). From an e-commerce perspective, more sales are generated during the 9-5 working hours than at any other



time (Nielsen 2000). The whole purpose of e-commerce is to give consumers a choice and the option of shopping using the Internet instead of visiting a shop. If we restrict shopping over the Internet in any way, how can we expect e-commerce to grow (Emarketer 2000)?

There is a benefit of using the Internet at work. Surfing or trading electronically can stimulate employee ideas that the company can use, or can monitor competitors' moves and take measures to reach the market first. As in the Internet revolution, competitors are only a click away. The Regulation of Investigatory Powers Act could act against this creative use of the Internet and may have the effect of inhibiting a company's ability to take advantage of the coming e-business revolution (Naughton John. 2000).

#### 4.5 E-Satisfaction can Increase Productivity and Quality

E-satisfaction (electronic satisfaction), a word created by the author, refers to the amount of Internet and email usage that employees feel they should receive from their company during working hours to keep them satisfied and their quality of work at a high level. However, the quality of work is also related both to material factors and to social or emotional factors. So how can companies increase the quality and effectiveness of their employees? Government has legislated on various aspects of the elements that affect job satisfaction. The minimum wage act has put a base under the pay scale, even if arguments about the level still continue. Regulations on unfair dismissal allow employees to receive compensation. The Health and Safety Acts protect physical well-being at work. Working hours legislation as well as family-friendly practices have attempted to address long hours and cater for working parents.

While considerable legislative efforts have been directed at the material and physical conditions of work, there now needs to be a greater emphasis on what are too often seen as the 'soft' issues in workplaces – respect, recognition, autonomy, opportunity



and sociability. These are factors that directly impact the quality of working life, day in and day out.

Guest and Conway (1999), in their review of employee satisfaction surveys for the Institute of Personnel and Development, concluded that “the majority of British employees are satisfied with their jobs; they do not feel insecure; and they have a high level of commitment to their employer”. If the majority of employees are satisfied with work, who is dissatisfied? The fact that most people work because they need money is borne out by other surveys (Hudson A. 1996). Part of the difficulty of understanding why people work is that although the salary and skill match matter to individuals, so too do intrinsic elements of work. Sixty-one per cent of all respondents to the Futures survey said that gaining new skills was very important in their decision to take their current job, while 47% said that belief in the company’s purpose or values was very important (Knell J. 2000). It seems that individuals want work both to pay well and to provide meaning.

Natural factors are less amenable to public policy interventions and it is hard to legislate for friendliness and respect. There is much that can be done to improve working life if the political will is there. Government intervention is not enough though. Companies need to realise that satisfied workers are more productive, efficient, loyal and innovative model employees (Doyle Judith. 2000).

Relatively simple things can make a big difference to the happiness of a company’s employees. Survey after survey shows that employees value having a friendly working atmosphere (Doyle Judith. 2000). Employers can give their staff more room to enjoy their work. Rather than seeing sociability at work as the antithesis to efficiency and productivity, employers need to see it as crucial to the bottom line. The Harvard Business Review reports that Sears found that a 5% rise in staff satisfaction leads to a 0.5% rise in productivity (Rucci A. Jan/Feb 1998).

According to Doyle (Doyle Judith. 2000) gossip is good. Providing communal space, such as coffee areas or a lunchroom, allows employees to share information and knowledge, and to build relations that benefit both the company and the employee. The more human resource practices are in place, the more satisfied employees are with their job and with life as a whole.

Improving the quality of work is a task for individuals, business and governments. Gordon Brown, the Chancellor of the Exchequer in the United Kingdom, once called for “full and fulfilling employment” (Doyle Judith. 2000). Now that full employment seems possible, it is time to focus on fulfilment at work.

To gain e-satisfaction within the workplace there has to be a clear understanding between both employers and employees on their e-policy. The e-policy must be seen to be fair to both parties, with employees having access to both the Internet and email, with monitoring used only for improving quality and employee effectiveness. If a trust can be built between employee and employer for future monitoring, both parties will succeed in making the office environment a better place to work, with the added extra of an increase in the quality of work and employee effectiveness.

#### 4.6 Recommendations for Company Policy on E-Monitoring

The research in the following chapters shows that electronic monitoring of employees can highlight areas that could be made more efficient within the workplace. In order to make the research experiments in this thesis successful, management had to be perceptive and secure enough to remove themselves from the immediate monitoring process. That meant that the data on individuals was not passed up to management. Only the overall figures were reported to management after the research had been completed. This concept is a hard one to accept for many managers, as they reason that they could use the data to do some aspects of their work more effectively, such as targeting promotion, or even firing. Their company has paid to have the data collected,



so why shouldn't it be made available to them? However, if individual confidentiality had been compromised, the data used against even one individual would have brought the entire data collection scheme to an abrupt halt (DeMarco T. and Lister T. 1999). Companies should endorse a reasonable code of ethics in e-monitoring. It would also help if the Government had a standard regulation for companies to use which states the regulations for monitoring and usage of email and the Internet.

It is suggested that the way forward for e-monitoring should be based on the research undertaken at the Danwood Group. The author, who undertook the monitoring process, was funded by a grant from the company but was not a company employee. As a full-time PhD student at Loughborough University, the author had an independent status that was more acceptable to the employees being monitored. This independence is likely to give more accurate results if employees know that information about individuals will not, except in extreme circumstances, be passed on to their managers. It is suggested that other companies would benefit from contracting any monitoring of employees' use of email and the Internet to an independent outside body. It is, however, important that both managers and employees agree on the terms and conditions of any such monitoring by an independent party.

Recommendations for a set of guidelines for electronic monitoring include the following.

- 1) An independent party should carry out any electronic monitoring of employees' use of email and the Internet.
- 2) Employees and employers should work together in creating an e-policy.
- 3) Employers should permit the use of the company Internet and email connections for personal use during non-working hours or lunch breaks, and by negotiation limited use could be permitted in working hours.
- 4) The emphasis of any monitoring should be to increase the quality and effectiveness of work, not for criticising individuals.



- 5) The results of monitoring must only be released to the individual concerned. Management should only be given combined statistical results, not any detail of an individual except in well-defined extreme breaches of the agreed e-policy (such as using the Internet for illegal activity or passing company secrets to competitors).
- 6) Sackings or other disciplinary action should not be made directly as a result of the information gained from electronic monitoring except in the well-defined case of an extreme breach of the agreed e-policy.
- 7) Results from electronic monitoring must not be used by employees to take legal action against the company except in the case of well-defined breaches of the agreed e-policy (such as improper use of monitoring information by the company).
- 8) The e-policy should be kept simple so that employers and employees can understand it.

## 4.7 Conclusions

The chapter has highlighted that electronic monitoring of employees' use of email and the Internet can be beneficial to a company and even to its employees. However, the use of monitoring and the resulting intrusion into personal privacy can also have adverse affects. Ideally, monitoring should only be used to increase the efficiency of the organisation and, in turn, this should create a better acceptance of being monitored within the workplace.

It is difficult for companies to obtain the right balance between private and work-related Internet use. This can only become more difficult as the use of e-technology increases and the technology itself becomes more advanced. A solution to this problem is to contract an independent outside party to undertake the monitoring process.

If the guidelines given in this chapter are followed then the company will benefit from increased employee effectiveness from better use of electronic facilities. The

employees would also benefit by being given some access to the company Internet facilities for private use and from the identification of any personal training requirement to increase their own effectiveness in the use of these facilities. The greater acceptability of independent monitoring, and the more relaxed atmosphere of a not too restrictive policy on email and Internet use, will increase the overall company morale which, in turn, will produce a happier, more effective environment that will benefit both employees and managers alike.

## CHAPTER 5 – ELECTRONIC MONITORING SOFTWARE

### Chapter Preface

All the software used for the email research for this thesis is explained within this chapter. The chapter is based upon the paper “Case Study: Evaluating the Use of an Electronic Messaging System in Business” presented at the EASE 2001 conference (Jackson T.W., Dawson R and Wilson D. 2001). This chapter shows the processes involved in both developing software and evaluating off-the-shelf applications that were used for electronically monitoring employees’ email usage. In both cases it was important to minimise the amount of intrusion into personal privacy due to the adverse effects that can arise when an employee knows they are being monitored. It also outlines problems encountered while monitoring employees’ communication and how they were overcome.

Through the use of the software detailed in this chapter, the value of measuring communication processes through electronic monitoring has been shown at the Danwood Group. The analysis of email has enabled the effect on employee time to be quantified, and has given some surprising results, which are described in Chapters 7 and 8. This has led to a series of recommendations that will enable companies to make better use of email communication and increase employee productivity.

### Chapter Keywords

Monitoring Software, Emails, Mobile Phone

### 5.1 Introduction

One difference between email and other communication media is that it is private, unlike the telephone. In a working environment everyone surrounding you can hear your telephone conversation, which makes it harder to use the telephone for personal



calls. It is important when trying to monitor email communication that the privacy of the medium is upheld to gain accurate working environment data. Varying results can be produced when employees think they know when they are being monitored (Jackson T.W. et al. 2001). To gain non-biased results it is important that the monitoring processes are not apparent to the employee and that the process produces accurate data. When selecting a tool to monitor email communication it is extremely important not to affect the employees using the email application in terms of disrupting the speed of their computer and making any noticeable changes to their customised desktop settings.

At the beginning of this email communication research in 1998, there were no email monitoring applications on the market suitable for the study. This led to email monitoring applications being built by the author. During the course of the study the process of building monitoring software went through a number of stages. Stage 1 involved developing an email application called the Danwood Mail to capture every detail of the employees' interactions with the email application. Rather than writing a bespoke email application it was decided to modify an existing one due to time constraints. However, there were difficulties in trying to obtain an existing email application with open source code, as many of the software companies did not want their software associated with monitoring. Eventually an open source email application was found and modified for stage 1 of the research. Due to a large overhead of having to add new features to keep the employees using the application, and fixing software bugs, the research moved into stage 2. After a review of commercial monitoring packages available it was decided to build another email monitoring package called SLMail In and SLMail Out that would monitor employees remotely from the server. During stage 2 commercial monitoring applications appeared on the market and were field-tested for the research study, but unfortunately produced poor results and could not be used. A review of these different applications can be found within this chapter.

The last phase of the research was to capture the interrupt recovery time of employees after an email interruption. A number of ideas were considered including different software applications. A review of these different ideas and software applications can also be found within this chapter.

## 5.2 Monitoring Software Client Side – Stage 1

A number of different approaches were attempted when trying to write the email monitoring software application. The first attempt was to write code in both Microsoft Visual Basic and Microsoft Visual C++ using API (Application Programming Interface) and DLL (Dynamic Link Library) calls to record the amount of time a GUI (Graphical User Interface) email window is active. If this was achieved it would then have been possible to record all field entries on the active window e.g. email recipient, sender, subject etc. This type of capturing method did not work as Visual Basic only captured information on GUI windows that were created within the Visual Basic application.

In the second attempt to write an application that would monitor email activity it was decided to modify an existing email application to save time and to reduce the number of bugs that might occur if building a bespoke application. Modifying an existing email application required the source code, and with many commercial applications this was not available. Microsoft Outlook, Eudora and Pegasus were approached for the research study but all refused, either because they did not want their software associated with employee monitoring or because the software was too confidential to release. Alternative solutions were sought and found in the sample files distributed with Microsoft Visual Basic and Borland Delphi. Both applications gave samples of a very simple email application with basic functionality. The Microsoft Visual Basic sample email application was chosen over Borland Delphi's because the author had experience in writing Visual Basic source code and it was deemed this would save on



development time and reduce the amount of software errors. The specification for the Danwood Mail application can be found in Appendix 5.

5.2.1 Danwood Mail - Beta and Release Versions 1 and 2

The initial email application provided by Visual Basic called “VB Mail” had many existing software errors which had to be fixed before any new code was written to monitor employees. The email application was renamed Danwood Mail and went through three beta versions before any new monitoring code was added. Some examples of the errors were that emails did not print, the user was unable to use the “Previous” and “Next” email buttons (shown in Figure 5.1) and the user could not reply to email messages in the “Message List” window (also shown in Figure 5.1).

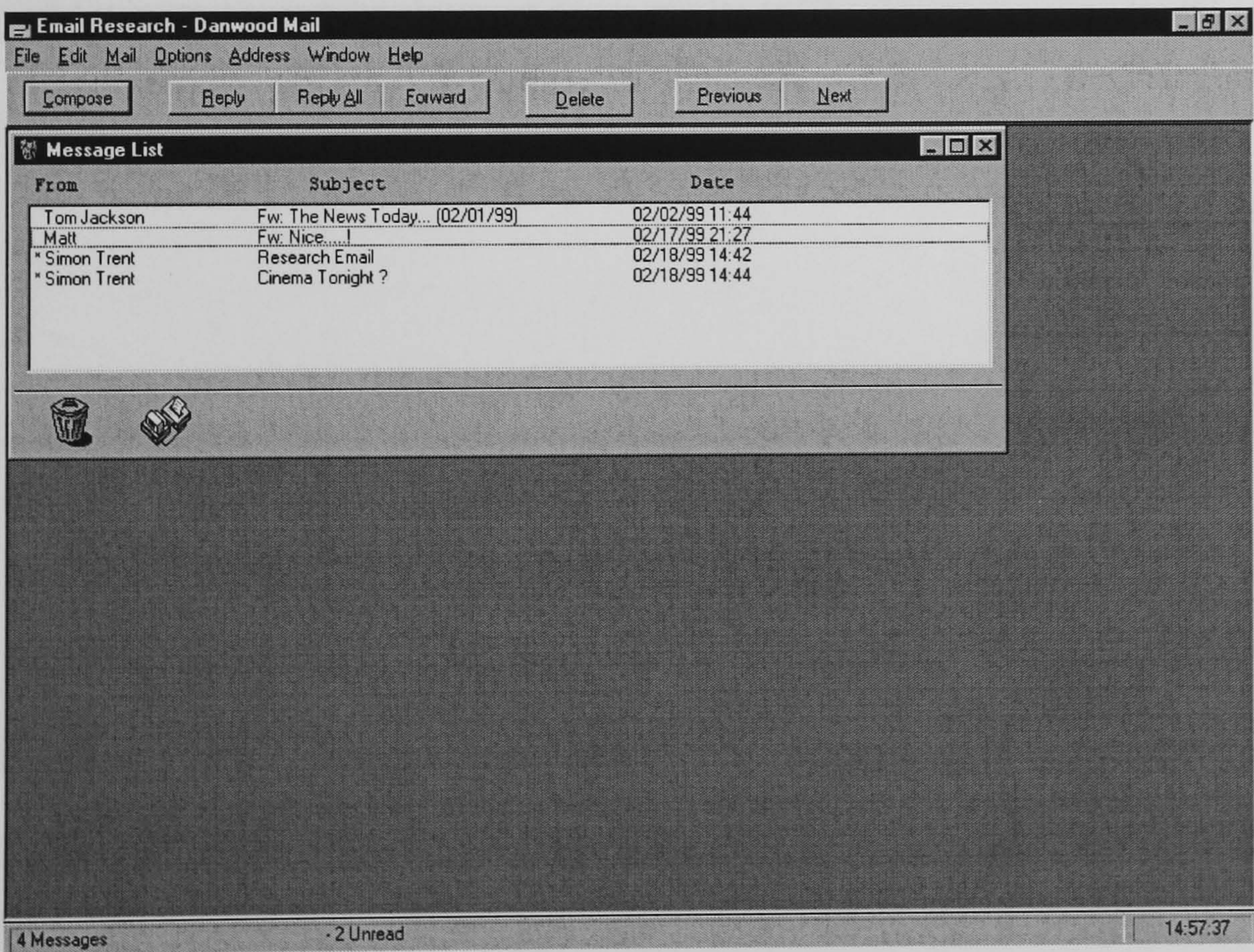


Figure 5.1 – The Danwood Mail Application



Once the errors had been fixed, monitoring code was added to version 1 of the Danwood Mail to record employees’ every interaction with the application. Most of the details were gained from the viewing window shown in Figure 5.2. The multi-purpose window was used to read and compose messages, and the software code written recorded every detail about the window including the amount of time the window had user focus. A window has focus when the user is interacting with it; the user can determine this by the shade of the title bar, which in the case of Figure 5.2 is showing a navy-blue bar with the wording “Send Note”. If the window was not in focus, the colour of the bar would be grey.

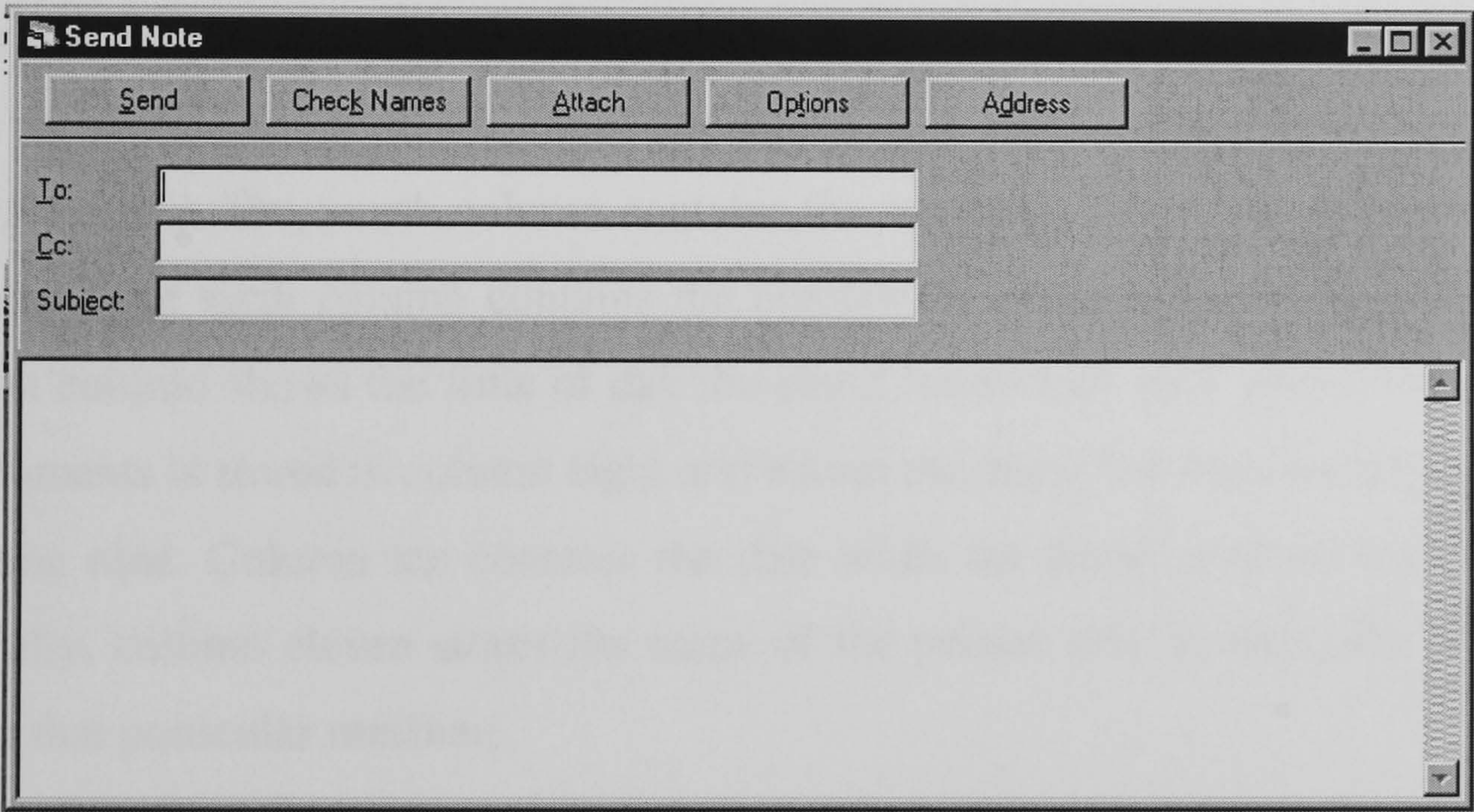


Figure 5.2 – The Danwood Mail Application

All the data captured was stored on the client-side machine and a new file was created every day with the day’s date as the filename. The first line of the file contained how many entries had been made into the file. The following details in Figure 5.3 have been taken from an actual employee’s machine at the Danwood Group (the names have been changed) and show typical entries for email interactivity with the Danwood Mail application.



```
5,8,"Glug!","Clare White","Bob Allan",53,"08:24:04","", "", "05-04-1999","Clare White"
5,12,"Coka Cola","Clare White","Bob Allan",44,"08:24:18",0,"", "05-04-1999","Clare
White"
4,0,"Coka Cola","", "Bob Allan",44,"08:24:22",0,"Deleted - CC","05-04-1999","Clare
White"
4,0,"Howdo...", "", "Bob Allan",228,"11:57:48",1,"Deleted - CC","04-09-1999, "Clare
White"
```

Figure 5.3 - Email monitoring file extract

The information in the first column determines the type of email message: 4 means delete email, 5 read email, 6 write email, 7 reply to email, 8 forward email and 9 reply to all on the recipients list. The information in the second column is the time in seconds it took the user to carry out the email interaction. The third column shows the subject line of the email. The fourth column contains the recipient. The fifth column contains the sender. The sixth column contains the number of words in the main email body. The next column shows the time of day the email interaction took place. The number of attachments is stored in column eight and whom the email has been carbon copied to in column nine. Column ten contains the date when the email interaction took place and finally, column eleven stores the name of the person who is using the Danwood Mail on that particular machine.

The deletions of emails were logged but not timed, as the time taken was insignificant. Email messages were normally deleted after they had just been read or deleted at a later date by simply highlighting the email in the received message window and pressing the delete key, and in both circumstances very little employee time was used to carry out the deletion operation.

When the rollout of the Danwood Mail began it replaced the Microsoft Windows Messaging application. Though not as sophisticated as Microsoft’s Windows Messaging application the Danwood Mail received good feedback from the Danwood users for its speed and user-friendly interface. To gain the captured data from the



Danwood Mail application without disturbing employees at their computer involved setting up a shared folder that could be accessed remotely and the necessary files downloaded. The Danwood Mail was originally set-up for sending and receiving internal email but it also had the capability of sending and receiving external email, though most of the email analysed was internal. The results from this study are analysed in Chapter 6.

5.2.2 Danwood Mail - Release Version 3

In trying to make the employees more aware about the amount of time they were spending on email communication and the types of messages they were sending and receiving, version 3 of the Danwood Mail was released. The final release included more detail about the type of message being sent and fixes for errors found in the version 2 release. The email message being sent can be categorised under three headings, which are business email, other email (non-business related) or unknown. Figure 5.4 shows the inbox of the version 3 release with an added column to show the type of message “T” and at the bottom of the inbox a key to show what the headings and content mean.

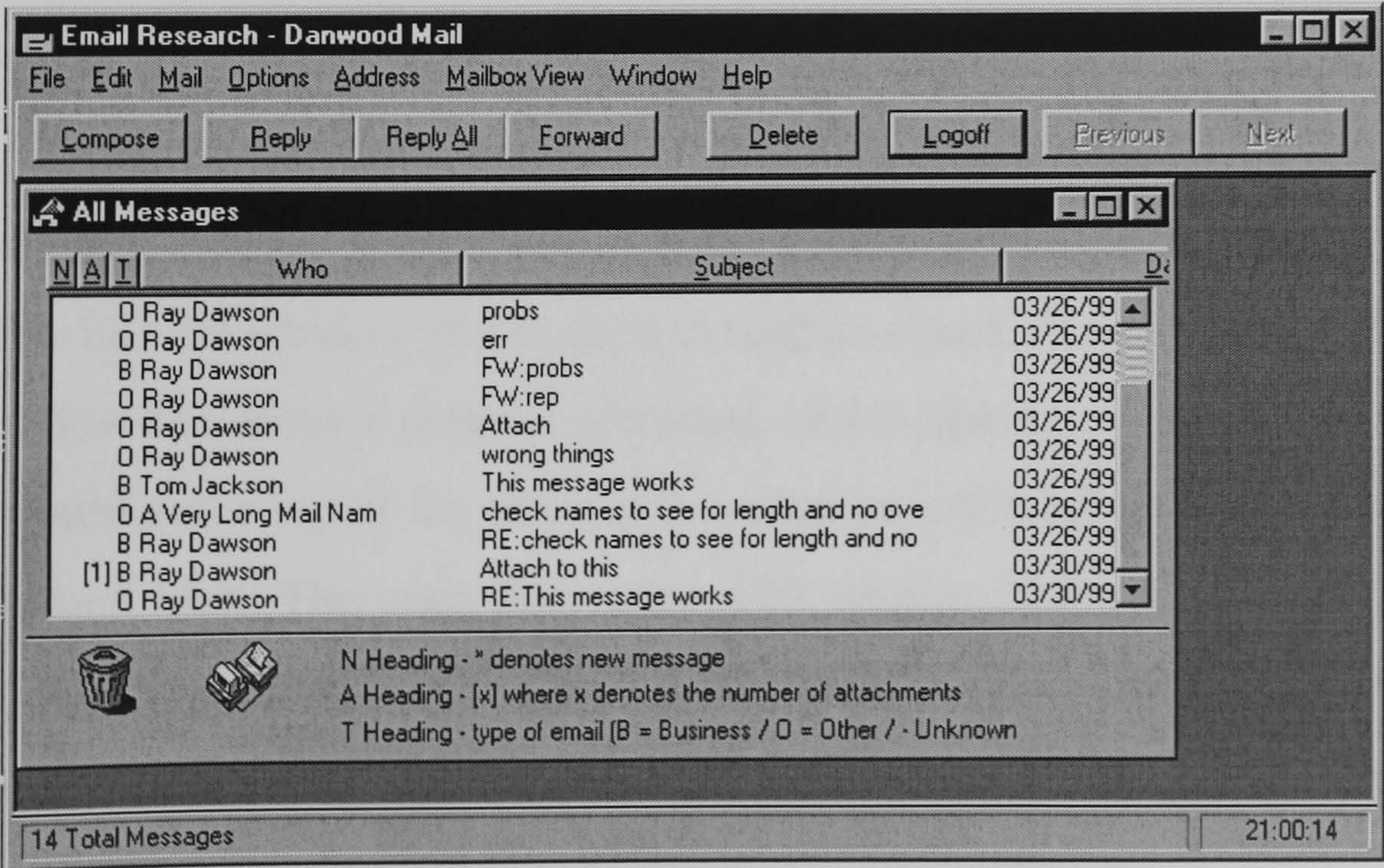


Figure 5.4 – The Danwood Mail Application



An example of how an email can be composed within the Danwood Mail Application can be seen in Figure 5.5.

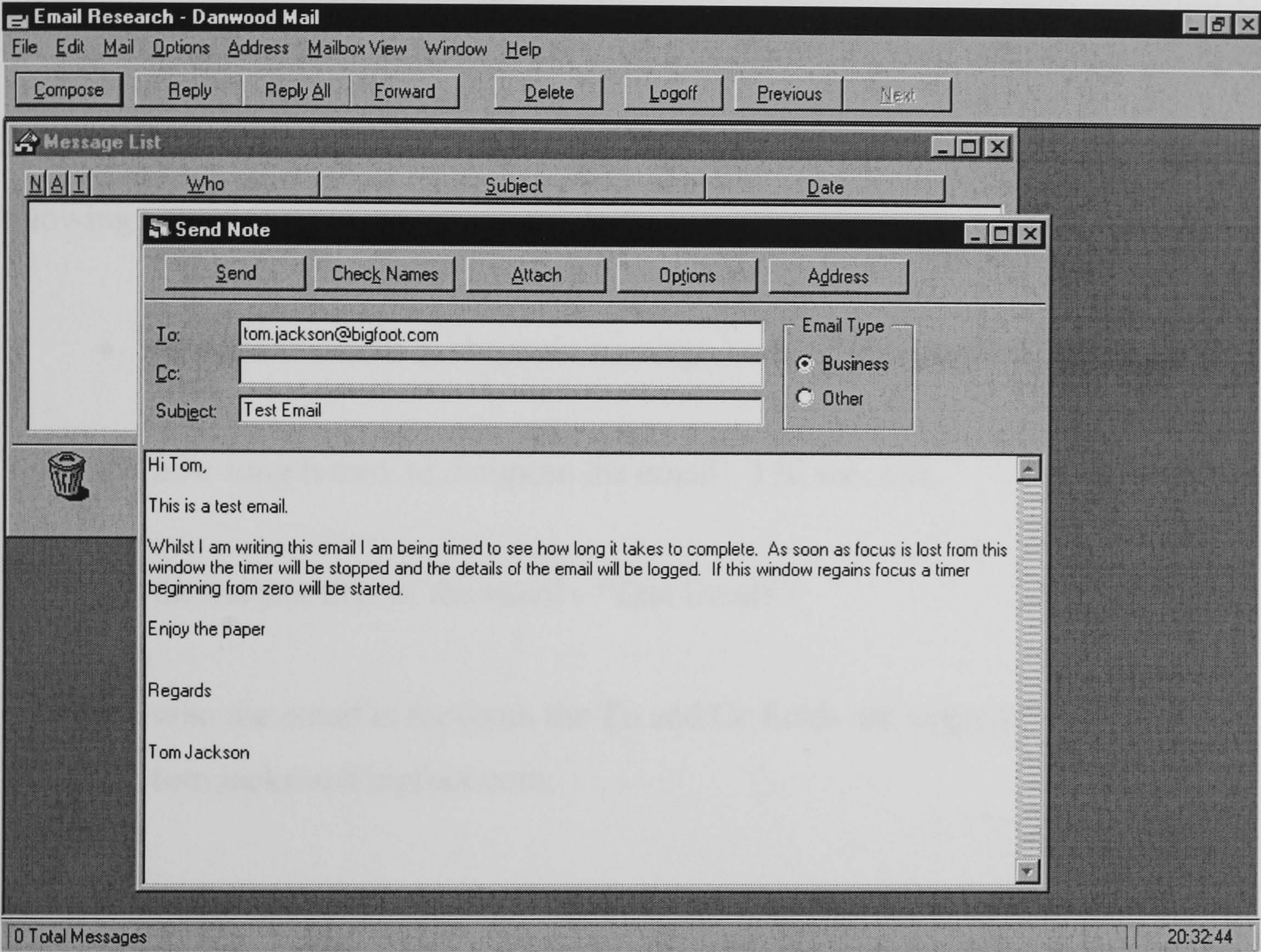


Figure 5.5 – Composing a Message in the Danwood Mail Application

The sub-window that has the focus is the composing window (“send note window”), which is also like the window that is used to read an email. Every time a composing or reading window has focus a timer is activated. Each time the window loses focus the timer is stopped and a log of the activity is written to a file as in the previous versions of the Danwood Mail. The main difference with version 3 is that the type of message sent is also stored. As shown in Figure 5.6 the twelfth and final column stores the type of message, which is either “O” for other, “B” for business or “U” for unknown.



```
5,8,"Glug!","Clare White","Bob Allan",53,"08:24:04","","","05-04-1999","Clare  
White","0"  
5,12,"Coka Cola","Clare White","Bob Allan",44,"08:24:18",0","","05-04-1999","Clare  
White","0"
```

Figure 5.6 - Danwood Mail file extract

For example if the sub-window in Figure 5.5 lost focus, the log would contain the following:

- number of words in the main message body of the email - 67 words;
- how long it took to compose the email - 136 seconds;
- the subject title of the email - “Test Email”;
- who the email is for (both the To and Cc fields are logged) - tom.jackson@bigfoot.com;
- the author of the email - Tom Jackson;
- the time and date the email window lost focus - 04/01/00 20:33:45;
- the type of email – in this case business (the default is other).

The new system of being able to categorise the type of email message, so that recipients could spend less time determining if the email was important to them or not, did not catch on as well as expected. A number of employees were reluctant to use the “other” category, even if the message was non-business-related, for fear of being caught sending a large number of non-work-related emails.

The overhead involved in having to update the software and fix bugs became increasingly more time consuming and reached the point of little benefit to the research study. At the same time the Danwood Group decided to introduce Microsoft Outlook throughout the company as the standard email application. At this point it was decided to stop email monitoring through the Danwood Mail and find an alternative solution that met with the company business model of introducing new email software.

### 5.3 Review of Monitoring Software for Stage 2

Stage 2 involved removing the Danwood Mail application, as maintenance was becoming too high and the users' needs became increasingly sophisticated. At the same time the company also decided to implement a new email client throughout the whole of the Danwood Group to minimise the maintenance overhead. The new company-wide software that was introduced was Microsoft Outlook and Microsoft Outlook Express. With a new email client being installed it was important to find new monitoring software that was capable of recording metrics from both Microsoft Outlook and Microsoft Outlook Express. The author carried out reviews of currently available software to try and find a suitable replacement.

#### 5.3.1 *Software Overview for Email Monitoring*

The author selected three monitoring applications and evaluated them against predetermined criteria which are shown in Table 5.1. There were three distinct areas in which an application had to perform well if it was to be used in the next phase of monitoring. All the selected applications were able to monitor employee interaction with the email client.

The first criterion that the software had to meet was "Reliability". The application had to produce reliable and accurate data and also not crash the client- and server-side computers. It was important for data to be reliable as the employees had to be



monitored throughout the whole day without any gaps in the recorded data. The second criterion that the software had to meet was "Privacy". It was important that the employees didn't know that they were being monitored. The software was checked to see if it displayed an icon in the system tray and if it produced a pop-up dialogue box on boot-up of the computer. The final criterion that the software had to meet was "Productivity". It was vital that the software didn't slow down the employees whilst carrying out their work. Both the client- and server-side computers were checked for decreases in speed.

### Measurements

- Data – How accurate and reliable was the recorded data? 0% represents that the data was unreliable and not accurate, whilst 100% represents total reliability and accuracy.
- System Crashing: Client – If the software was based client-side then how often during a day did it crash?
- System Crashing: Server – If the software was based server-side then how often during a day did it crash?
- Systems Icon – If the software produced an icon in the system tray then "Yes" would be recorded, otherwise "No".
- Pop-up Dialogue Box – If the software produced a pop-up dialogue box on boot-up of the computer then "Yes" would be recorded, otherwise "No".
- Client-Side Speed – Any decrease in speed of the client-side computer would record a "Yes", otherwise "No".
- Server-Side Speed – Any decrease in speed of the server-side computer would record a "Yes", otherwise "No".

	I-SPY	Windows Ranger	Back Orifice 2000
<b>Reliability</b>			
Data	100%	100%	100%
System Crashing: Client	0 a day	2 a day	0 a day
System Crashing: Server	0 a day	3 a day	10 a day
<b>Privacy</b>			
System Icon	Yes	Yes	No
Pop-up Dialogue Box	Yes	Yes	No
<b>Productivity</b>			
Client-Side Speed	No	No	Yes
Server-Side Speed	No	No	Yes

Table 5.1 – An overview of the software reviewed for the second phase of email monitoring at the Danwood Group.

A more detailed analysis of the software applications in Table 5.1 can be found in Appendix 9. After reviewing the software applications it is clear from Table 5.1 that none of the applications could offer total reliability and privacy with no decrease in productivity. Therefore the author decided to develop his own email monitoring application that would offer top marks in reliability, privacy and productivity.

5.4 Monitoring Server-Side Software – Stage 2

The new monitoring system was developed to be server-based and run on a dedicated machine to increase reliability. The specification for the email monitoring application can be found in Appendix 6. Unlike the Danwood application, the new software was not able specifically to record the amount of time an employee spends on an email, as it is harder to monitor numerous individuals from the server. Through the introduction of the new software the results of the previous research study were checked against the



new software results for consistency and accuracy, which added greater validity to the results.

The server-side software was written to work with the new Danwood Mail server, which was running SLmail from Seattle Labs. SLmail is a complete email solution which is simple to use and powerful. It conforms to the open Internet standards and works with any email client that supports standard SMTP (Simple Mail Transport Protocol), ESMTP (Extended Simple Mail Transfer Protocol), or POP3 (Post Office 3) Internet protocols, including Quickmail Pro, Eudora, Agent, Pegasus, Z-Mail, Netscape, and Microsoft Outlook (Seattle-Labs 1998).

#### *5.4.1 SLMail Metrics Out*

One of two applications written by the author in Visual Basic to run on the server to monitor external email was called SLMail Metrics Out. The program monitored employees' email by analysing the files in the mail out folder on the SLmail server. The program first copied a mail file to a local folder, to avoid locking the file on the mail server, and second opened the copied mail file associated with the employee, extracted details and entered them into a text file in the root directory (as shown by a file extract in Figure 5.7). A new file was created every day, with the date of that day used as the filename. Figure 5.7 shows extracts from a file produced by the SLMail Metrics Out application. If the monitoring application could not read a mailbag, it would store the details of which mailbag it could not read and copy it to a separate folder for manual processing. For example, the David White mailbag could not be read, so the filename, the subject and the date were stored. If a mailbag was readable, e.g. Lesley Chaple, the following details were stored: sender, recipient, subject and date.



```
"david.white.mbx",, "Subject: Liquid Point", "Date: Fri 25Jun 1999 11:45:32 +-200"  
"From-<lesley.chaple@danwood.co.uk>", "To-<sue.taylor@danwood.co.uk>", "Subject:      FW:  
Branch Administrator Training", "Date: Mon 19Jul 1999 11:34:00 +0100"
```

Figure 5.7 – The email information taken from the SLmail folder

The SLMail Metrics Out application did not require a GUI interface; but it was included, as shown by Figure 5.8, to give confirmation that the application was still operating successfully.

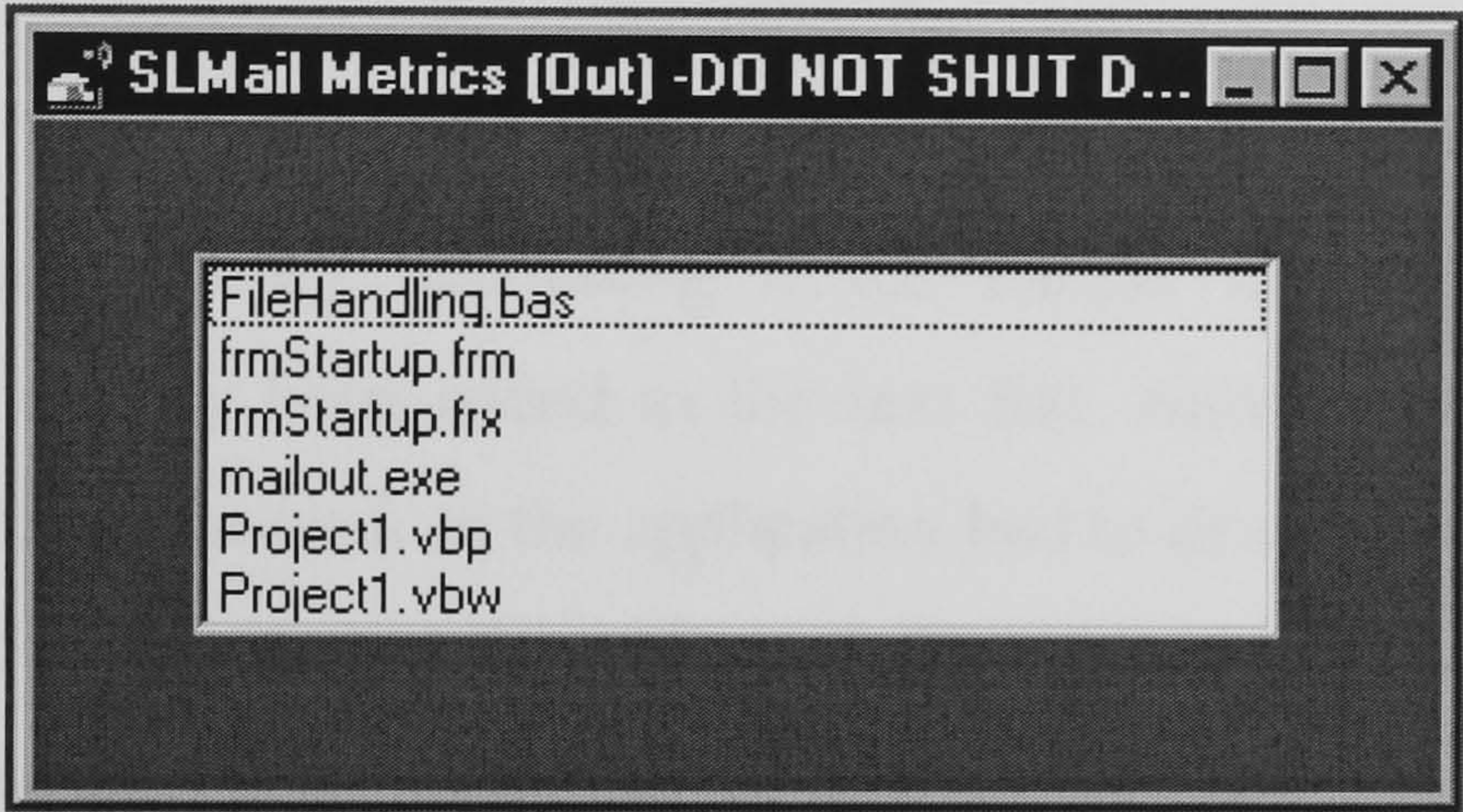


Figure 5.8 – The graphical feedback of the SLMail Metrics Out application running successfully

5.4.2 *SLMail Metrics In*

The SLMail Metrics In application was identical to SLMail Metrics Out except that the program monitored employees’ email by analysing the files in the mail “in” folder on the SLmail server instead of the mail “out” folder. The same graphical user interface was used, but the application name was changed to avoid confusion when both of the programs were running (shown in Figure 5.9). Both programs had the same back engine and had to be sophisticated enough to deal with complex mail files. Many mail files contained multiple emails for an employee. The SLMail Metrics applications determined if the email had already been added to the text file shown in Figure 5.7.



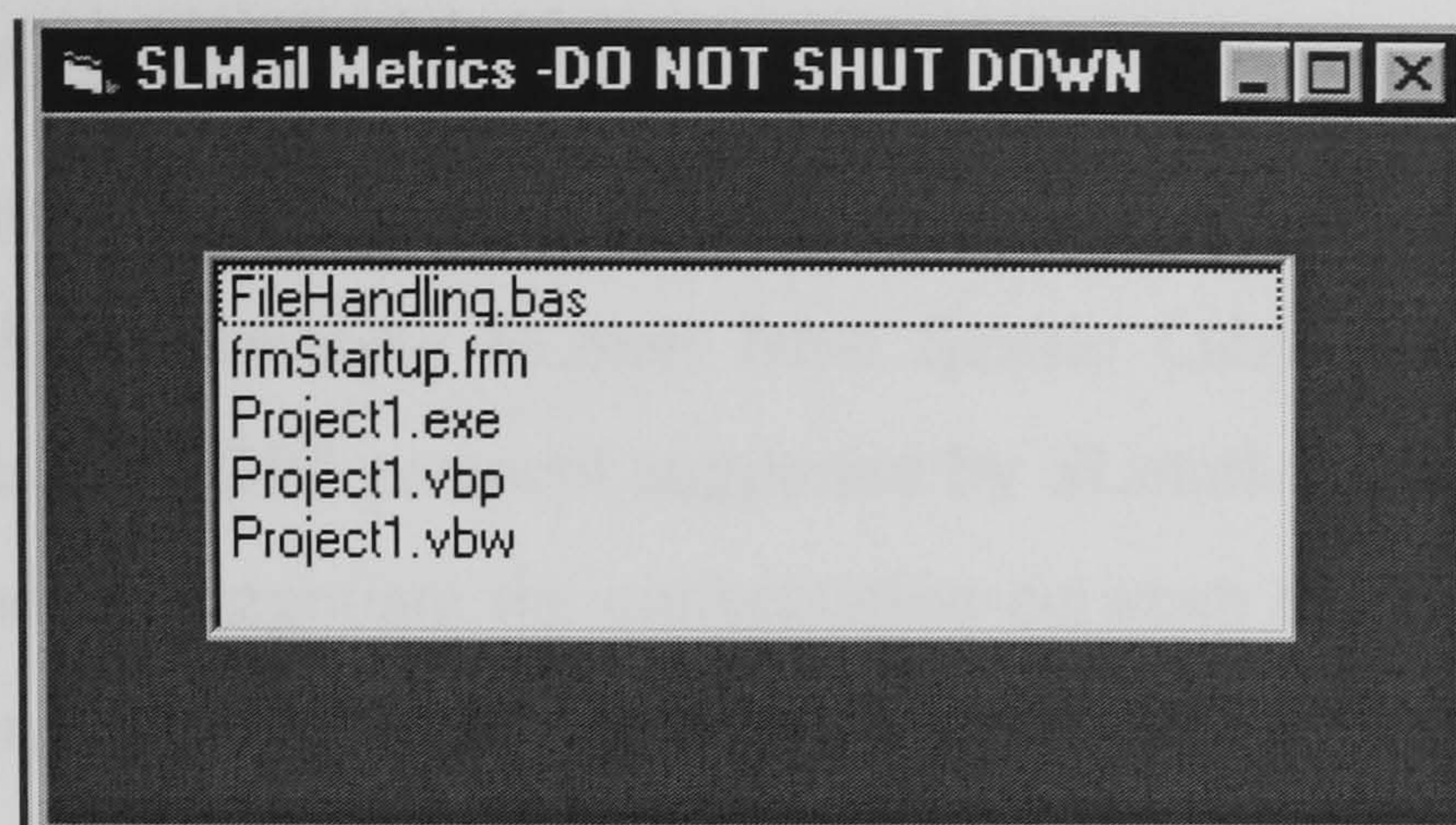


Figure 5.9 - The graphical feedback of the SLMail Metrics In application running successfully

The application did this by calculating if the unique identifier, which was the 'message-id', had already been added to the text file. Another problem was storing mail files that could not be read, as the application had to determine if the mail file had been updated or if it was a new file. All mail files stored had to have an extension added to the filename. For example, a mailbag filename took the format of firstname.surname.mbx. If the file could not be read, then it was copied to a folder for manual processing; but before it was copied to the folder a check was carried out to see if the filename already existed. If the filename existed the next available extension was added, e.g. firstname.surname001.mbx

This method of data capture led to a massive overhead of having to analyse the files that could not be read and the possibility that some emails were being missed due to the time lost in having to copy the mail file to a separate folder to reduce the possibility of file locking. If the mail file had attachments the copying process took a considerable amount of time, which could have led to some emails being missed, as over 200 employees were downloading their email asynchronously every 5 minutes. With the uneconomical analytical overhead it was decided to develop a more sophisticated application that would process the information more effectively, which led to the development of POP3 (Post Office 3) Mail Collection.



### 5.4.3 *POP3 Mail Collection*

To make the monitoring software more efficient required direct communication to the mail server, which was running SLmail from Seattle Labs. This was achieved by communication via the POP3 protocol supported by SLmail. It was decided to buy in the software that would negotiate the conversation between the author's software and the SLmail server, as this would increase reliability by reducing the number of potential software errors. The specification for the POP3 Mail Collection application can be found in Appendix 7.

The SMTP (Simple Mail Transport Protocol) and POP3 (Post Office 3) Email Engine library for Visual Basic were purchased from MarshallSoft Computing. The library of functions provides easy control of the SMTP and POP3 protocols and the simple interface allows for sending and receiving email, including multiple MIME (Multipurpose Internet Mail Extensions) base64 and quoted-printable encoded attachments. With the SEE4VB DLL (Dynamic Link Library), it was possible to write a GUI program that would send email with optional MIME attachments, get the number of messages on the email server, get the header lines from any email on the server, delete any email on the server without reading it first and receive any email on the server including MIME attachments. The software had been tested against multiple email clients, including Eudora (Lite & Pro), Microsoft Outlook, Pegasus, Calypso, PM Mail 98, Actif Mail, Lotus Notes, and Netscape. The library had also been tested against a variety of UNIX and Windows servers on the LAN (Local Area Network) and on the Internet (MarshallSoft-Computing 2000).

With the graphical interface already built, shown by Figure 5.10, the next stage of development was to store the information gained from polling the employees' email accounts on the SLmail server into a database for easier manipulation. Two tables were created in the Microsoft Access Database application. The first table contained the login details to gain access to each employee email account, and the actual fields were UserName, Password, FileLastAccessed, MailBoxName, MsgNo.



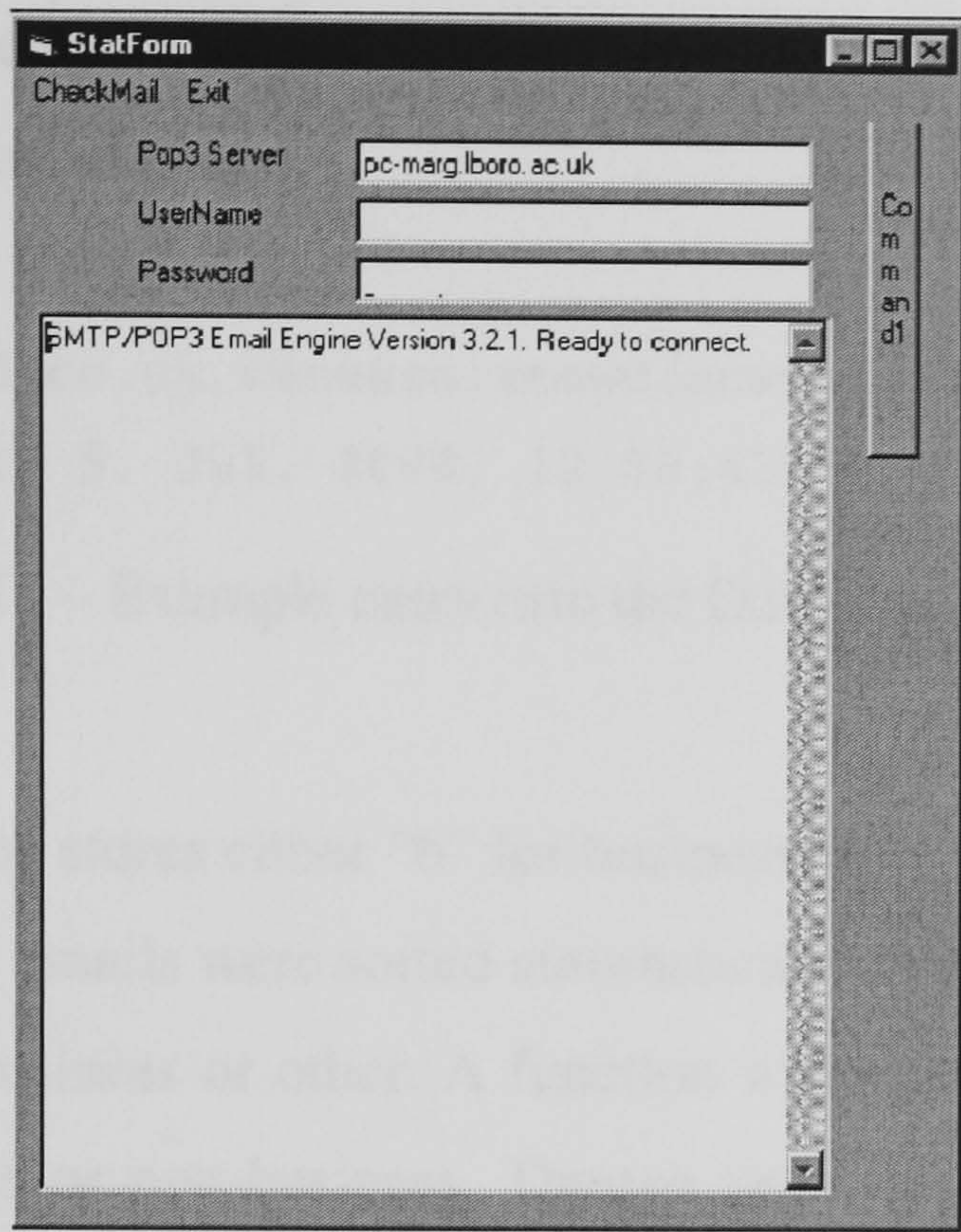


Figure 5.10 – The GUI interface for the POP3 Mail Collection Application

The username, password and MailBoxName fields in the table were required to access specific employee SLmail accounts. The FileLastAccessed and MsgNo were used to determine if any new messages had been added to the employee’s mailbox since the last time the POP3 Mail Application had been checked. The FileLastAccessed field stored the time when the mailbox file was last updated and the MsgNo field stored how many email messages were in the mailbox the last time it was accessed. From this information it could be determined if any new messages had arrived and more importantly which email messages needed to be added to the database table avoiding email duplication.

The second table stored information about the type of email in the employee’s account, and the fields are Sender, To, Subject, EmailDay, EmailNum, EmailMnth, EmailYr, TimeOfEmail, EmailType. Figure 5.11 shows an example entry into the database. The names have been changed, but the remaining information is from the original email sent. The first three entries into the database are self-explanatory, sender of the email, intended recipient and the subject of the email. The next five fields contain information



of when the email was sent, the day of the week, the day of the month, the month, year and finally the time of day.

```
suzan.temple@danwood.co.uk,vanessa.snow@danwood.co.uk,Grampian Uni  
Hospital SD2275, Wed, 5, Jul, 2000, 12:30:47, b
```

Figure 5.11 – Example entry into the Database for Table 2

The final field EmailType stores either “b” for business or “o” for other, for the type of email message sent. The emails were sorted automatically by the POP3 Mail Collection application into either business or other. A function within the application determined if an email was business or non-business. Though not a highly scientific function to determine the type of email, it had an accuracy rate of 63%. This was calculated by analysing all the emails that had been sent by the employees over a 1-month period. The function worked by looking for these characters in both the email subject and body: .., !, party, house, joke, hi, hmm, ?, oops, doing, pub, where. However, it is advisable that these words are reviewed periodically to check if they still reflect non-business emails, as the changing of staff and the addition of new slang words may change the content of non-business emails. The function worked on a points system and if any of the characters were found a point was awarded, and if two points were scored the email was categorised as non-business. The author chose the characters after analysing numerous Danwood Group emails. The selected characters were normally found in a non-business email. The characters chosen are specific to the Danwood Group and if used in another organisation to categorise email they might not achieve the same accuracy level.

To ensure the POP3 Mail Collection was running, the author built in an added extra to keep track of the application remotely through email conversation. The functionality allowed for the POP3 Mail Collection system to give confirmation that it was still running and also to email the database directly to the author’s email account. If an email was sent and processed by the POP3 Mail Collection application with one of



these two as the subject line, “Email Database” or “Up & Running”, an email would be sent to the author confirming that the application was still running and, in the case of the “Email Database” subject line, the database would also be attached to the confirmation email.

#### 5.4.4 *Email Pickup Times*

At the same time that individual employees were being monitored, every employee using email at the Danwood Group was also being monitored for the frequency of individual email collections from the server. The specification for the Email Pickup Times application can be found in Appendix 10. The author developed a program that monitored the email server to determine when employees picked up their email. The simple program was written in Visual Basic and recorded the name of the employee and the time the employee downloaded email from the server to their local machine as shown by Figure 5.12. A new file was created every day with the date of that day used as the filename.

```
"jane.millington.mbx", "08:06:02"  
"sharon.driffill.mbx", "08:11:27"  
"root.mbx", "08:12:19"  
"vanessa.hall.mbx", "08:18:44"  
"root.mbx", "08:22:25"  
"diane.quibell.mbx", "08:27:09"  
"becky.stocks.mbx", "08:36:36"  
"beth.rose.mbx", "08:36:36"  
"darren.wilson.mbx", "08:36:36"  
"dianne.evans.mbx", "08:36:36"  
"fiona.kelly.mbx", "08:36:36"  
"jenny.white.mbx", "08:36:36"
```

Figure 5.12 – An extract from the Email Download Frequency File

The Email Pickup Times application only recorded successful email downloads and not the attempts made to check if emails were on the server for that individual employee. The data captured by the application is discussed in Chapter 6.

## 5.5 Recording Email Interrupt Recovery Times

As a new type of email monitoring research was introduced, a new type of monitoring system was required to capture the interrupt recovery time of employees after an email interruption. There were numerous ways the interrupt recovery time metrics could have been recorded. The most obvious way was to record the employees at their desk, carrying out various activities and capturing them on a camcorder. Unfortunately the Danwood Group board of directors deemed this method inappropriate. Another possibility would have been to have an actual person watching from a distance the employee at their desk. This method would have probably produced distorted results due to the employee knowing they were being monitored through the constant presence of the monitor (Mayo, 1933). The last option considered was to use computer software to monitor the employee. A number of different applications had already been reviewed for similar research (Back Orifice 2000, Sentinel's Windows Ranger and I-Spy) but were dismissed due to a number of reasons outlined previously in this chapter. For these same reasons they were not used in the interrupt recovery times research, so that a new software package had to be found.

### 5.5.1 *Software Overview for Recording Interrupt Recovery Times*

The author selected two monitoring applications and evaluated them against predetermined criteria which are shown in Table 5.2. There are four distinct areas in which an application had to perform well if it was to be used for interrupt recovery time monitoring. Again, like the other email monitoring applications reviewed in this chapter, both the selected applications were able to monitor employee interaction with the email client. They were also capable of capturing the interrupt recovery time after



an email interruption. In the previous review of applications in this chapter three out of the four criteria stayed the same, “Reliability” ”Privacy” and “Productivity”. However, a new criterion was added for the email interrupt recovery time monitoring. The “8 Hours Monitoring” metric was used to determine if the applications were capable of monitoring the employees for at least 8 hours a day.

Measurements

The measurements for “Data”, “System Crashing: Client”, “System Crashing: Server”, “Systems Icon”, “Pop-up Dialogue Box”, “Client-Side Speed” and “Server-Side Speed” are the same as previously explained in Section 5.3.1 of this chapter. If the application could monitor an employee for at least eight hours a day then the “8 Hours Monitoring” metric would record a “Yes”, otherwise a “No”.

	Lotus Screen Cam	WinVNC
<b>Reliability</b>		
Data	100%	100%
System Crashing: Client	15 a day	0 a day
System Crashing: Server	0 a day	0 a day
<b>Privacy</b>		
System Icon	No	Yes
Pop-up Dialogue Box	No	No
<b>Productivity</b>		
Client-Side Speed	No	No
Server-Side Speed	No	No
<b>Data Storage</b>		
8 Hours Monitoring	No	Yes

Table 5.2 – An overview of the software reviewed for the interrupt recovery time phase of monitoring at the Danwood Group.



After reviewing the software applications it can be seen from Table 5.2 that both applications were unsuitable for interrupt recovery time monitoring. Lotus Screen Cam was unreliable and WinVNC was not private enough. However, WinVNC was chosen to monitor the employees as the author thought the WinVNC system tray icon would go unnoticed by the employees — it looked like an anti-virus icon, which they were already familiar with. WinVNC was also chosen because it was the best in the reviewed packages to date, it is free, it has open source code which could prove useful, and most importantly it is extremely reliable.

As Lotus Screen Cam was determined not suitable for the interrupt recovery time monitoring experiment, it will not be reviewed in this chapter. However, a more detailed analysis of the application can be found in Appendix 9.

### 5.5.2 WinVNC (Virtual Network Computing)

WinVNC is a remote display system that allows viewing of a remote computer desktop environment, not only on the machine where it is running but also from anywhere on the Internet and from a wide variety of machine architectures (Cambridge, 2000). WinVNC is a VNC server which will allow viewing of the Windows desktop from any VNC viewer and which only supports a single graphical user being logged in at any one time. WinVNC makes the existing desktop of the PC available remotely, rather than creating a separate desktop as with the Unix server (Cambridge 2000).

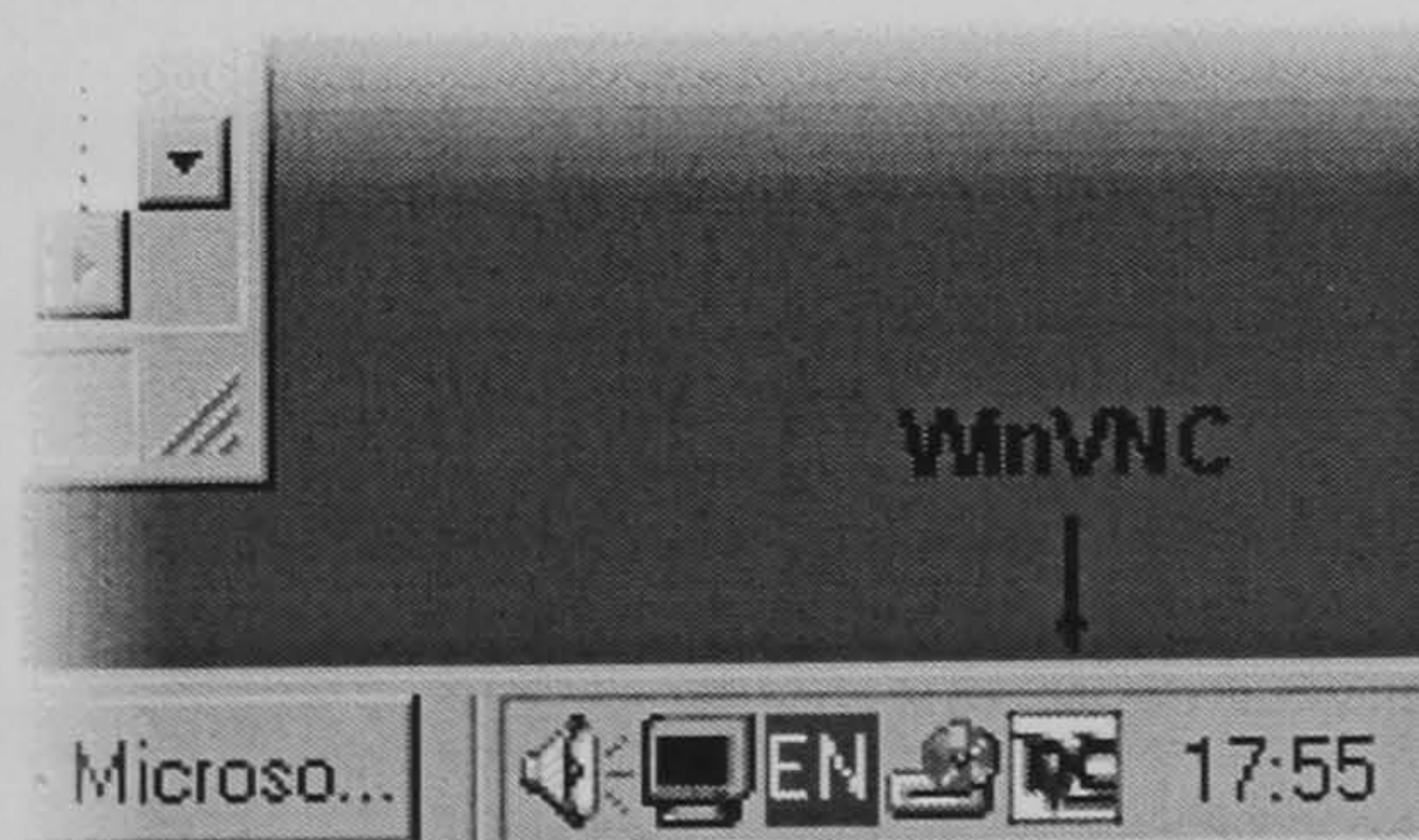


Figure 5.13 – Shows the WinVNC icon that was later removed from the system tray



WinVNC was set-up on both the client and server sides to allow monitoring of the employees' machines remotely. After trialing the application on a few computers, it was discovered that the WinVNC icon shown in Figure 5.13 did cause a distraction to employees, contradictory to the author's first opinion. When WinVNC was activated remotely, the icon in the system tray would inverse its colours to become mainly black. This caught employees' attention and they tried to disable it through its right-hand mouse-click menu system. The original WinVNC program was then modified slightly by the author to remove the icon shown in Figure 5.13 from the system tray and to remove the right-hand mouse-click menu so that employees would not be able to disable it. With the icon removed employees would not know when they were being monitored. The reliability of WinVNC was excellent and there was no noticeable speed reduction on either the client- or server-side machines. To record employees' activities for eight hours a day required a large storage medium. The server-side machine had an ATI 128 All-In-Wonder graphics video card installed, so a video recorder could be attached to record employee activities during the day. Four-hour videotapes were used in long-play recording mode to give a full eight hours of recording. After the initial trial it was decided this was the best available set-up at that time to fulfil the research requirements required to capture interrupt recovery times.

## 5.6 The SMS Email Tool

The objective of the Short Message Service (SMS) research project (detailed in Chapter 7) was to develop an internal SMS application that could be accessed through Outlook 2000 to send one-line emails. This is a short form of email based on the SMS facility for mobile phones. The new communication format was introduced for computer users at the Danwood Group, to see if the amount of time an employee spends on email can be reduced and whether the email becomes more structured through using the new tool. The specification for the SMS Email Tool application can be found in Appendix 8.

To enable employees to send single-line text messages internally, a specific SMS email application had to be developed to bolt onto the existing email application. The application was developed by Brett Johnson as part of his final year BSc project called “Improving the effectiveness of email at Danwood”. As this initial research was part of a pilot exercise it was important to develop a widely compatible SMS email tool that could be used within other organisations, so that further more detailed results could be obtained.

Outlook 2000 offers development tools that allow a developer to create new forms and applications that require the use of an email model. The email model is defined as client to server – server to client. The email model allows applications to be developed around the existing organisation’s email environment. It was decided to use this approach rather than develop the system in Visual Basic because the object model of Outlook 2000 is adhered to when designing custom applications. The forms are user-friendly to both the developer and the user, and they inherit similar attributes to the other forms in Outlook. This was extremely beneficial to the project as it was necessary to keep the short message service consistent with the other functions, so as to keep the same look and feel to the whole application.

### *5.6.1 Configuration*

In Figure 5.14 all the laptops are configured with Outlook 2000 and are connected to the SLMail server as indicated by the blue arrows (the lines with dots) for sending standard SMTP / POP3 emails. For the SMS service to function, Outlook 2000 was connected to the Windows Post Office via the MSMail connector to send and receive SMS messages with the MAPI protocol. The red circle with a cross in Figure 5.16 represents the software component that allows Outlook 2000 to communicate with the Windows Post Office. The software component MSMail connector is configured on each individual machine that connects to the Windows Post Office.



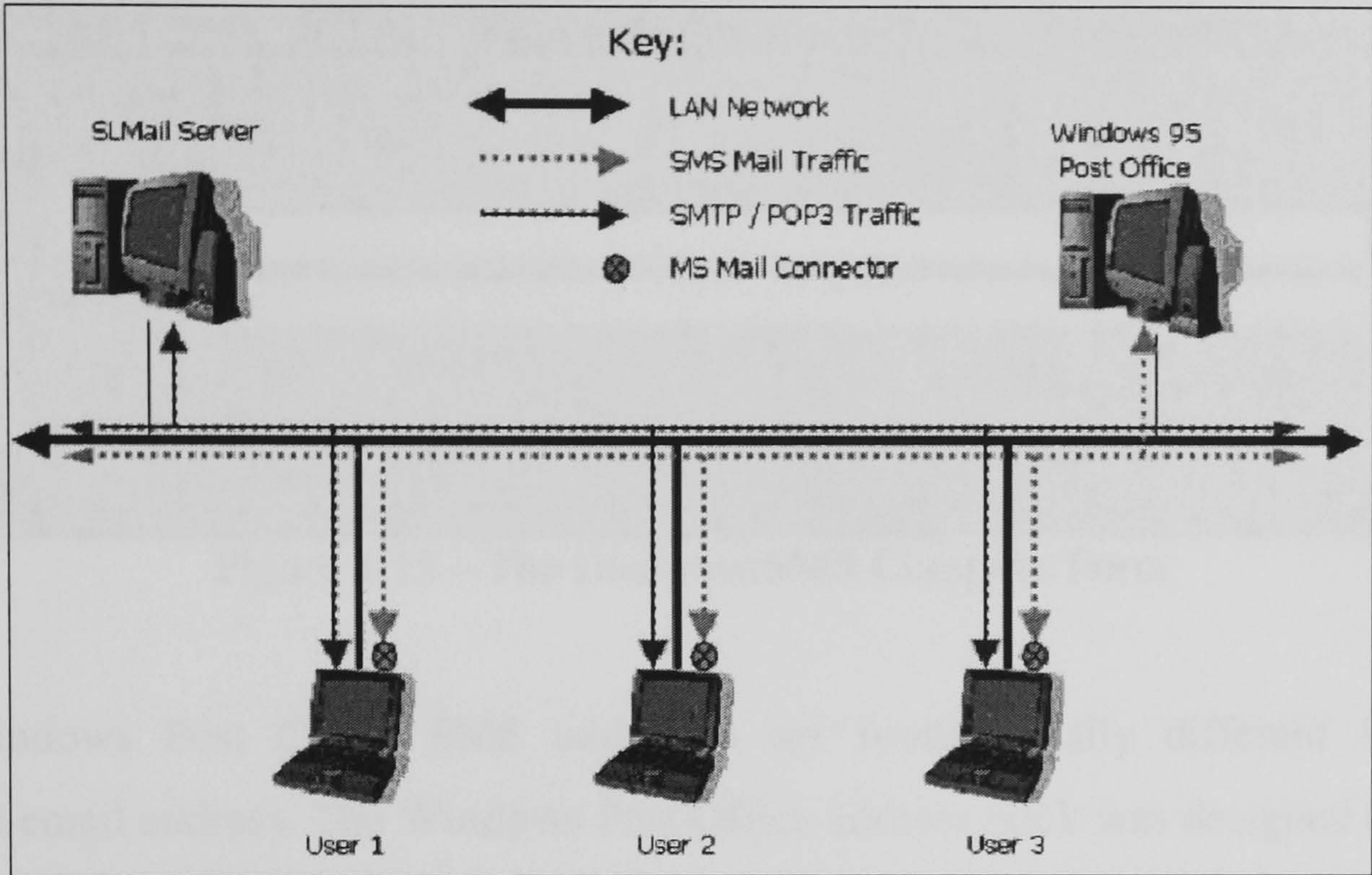


Figure 5.14 – How SMS messages are delivered

The key to successful delivery of SMS messages was through the users’ Contacts folder and the Post Office address book. While observing, it was noticed that very few users manually wrote in the email address when sending an email. One of the reasons for this was to eliminate mistakes made when typing in the email address into the “To...” field. The preferred method was to select the email addresses from their Contacts folder. All the users at Danwood have all their email addresses held in the Contacts folder within Outlook 2000. There was no global address book on the SLMail server for users to select email addresses from. Instead each user had to manually enter all the email addresses into their contacts folder.



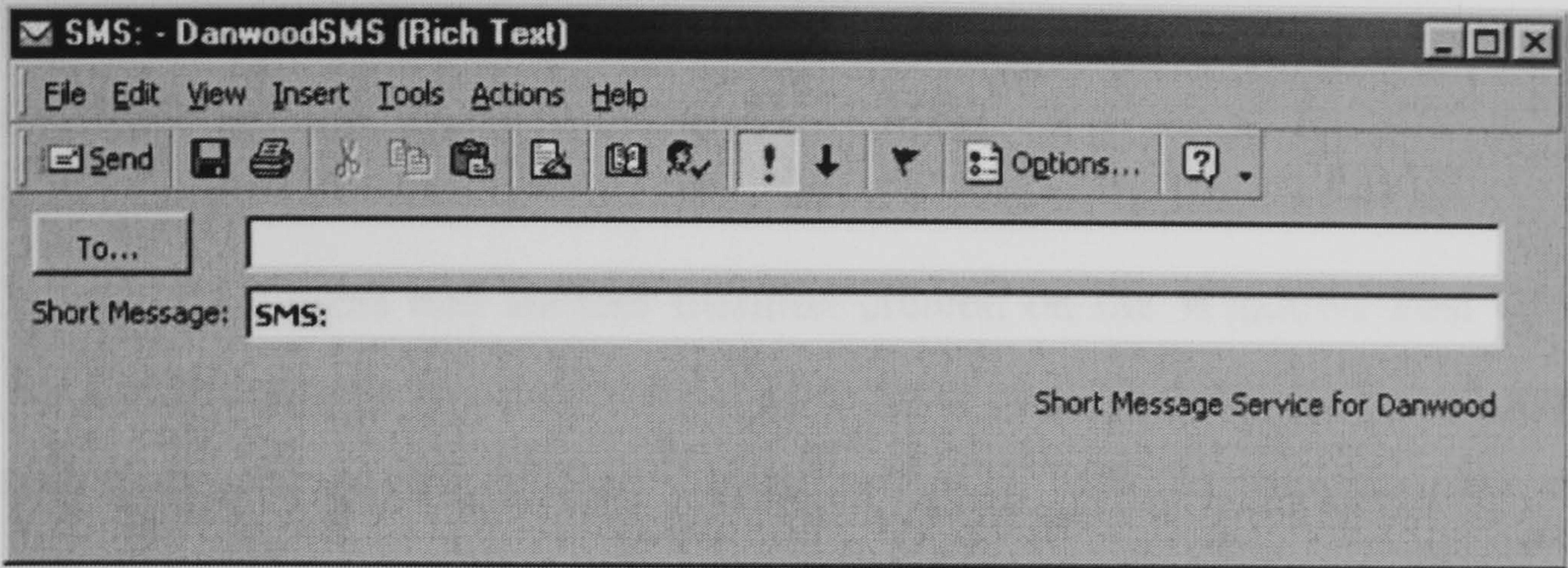


Figure 5.15 – The DanwoodSMS Compose Form

The Windows Post Office SMS addresses are fundamentally different from the standard email address. The Windows Post Office address book was designed to follow the format “SMSFirstname.Surname”. When a user opens the DanwoodSMS form as shown in Figure 5.15 and clicks on the “To...” button, the “Select Names” form is displayed as shown in Figure 5.16.

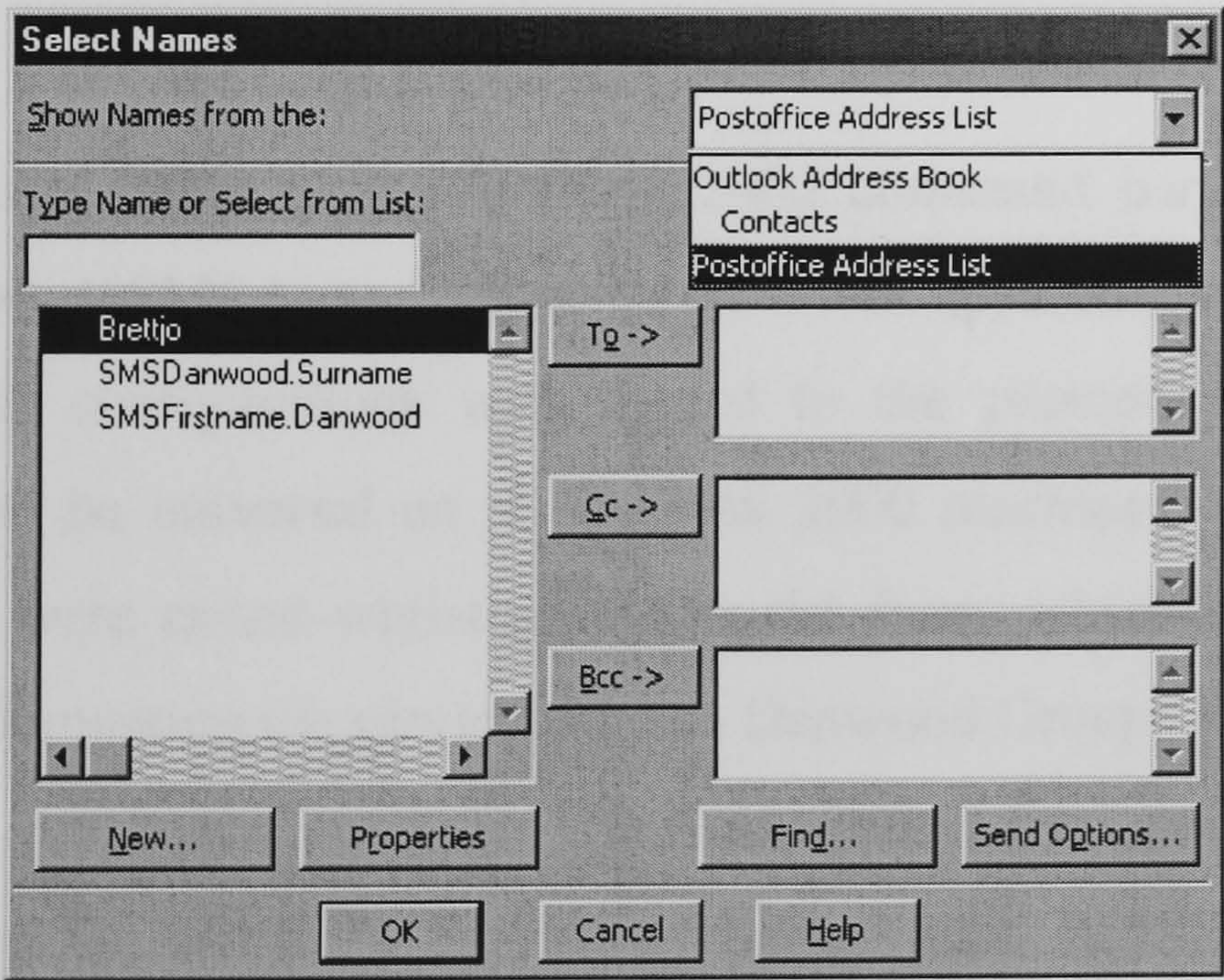


Figure 5.16 – Users email address book (Select Names form)

Figure 5.16 illustrates the two address books available to the user from the drop-down menu, Contacts and the Postoffice Address List. Selecting the Post Office Address List displays a list of all the users configured to send and receive short messages. Selecting



an SMS address from the Post Office Address List allowed the short message to be sent to the intended recipient via the Windows Post Office.

The Outlook 2000 users had another mailbox created on the Windows Post Office in order for SMS messages to be delivered. Therefore, each Outlook 2000 user now had two mailboxes, one on the SLMail server for SMTP / POP3 mail and one on the Windows Post Office for SMS messages. The mailboxes were configured on the Windows Post Office for each user, creating a global address book. A global address book is an address list that is available to all Outlook 2000 clients through the MSMail connector from the Post Office server. The main advantage with this configuration is that, if a new employee joined the company, a mailbox would be created on the Windows Post Office and the SMS email address would be available for all the Outlook 2000 users without any manual entry from the employee.

### 5.6.2 *Security*

An SMS button was added to the Outlook 2000 command bar and when pressed displayed the DanwoodSMS form (Figure 5.15). It was apparent that all Outlook 2000 users had identical configurations with regard to the personal forms library that allowed the code to be universal on all Outlook 2000 machines. However, concerns regarding security were raised whilst accessing the form, which it was necessary to resolve before implementing the service into the Danwood Group.

The button added to the command bar can be looked upon as a macro. A macro is a saved sequence of commands or keyboard strokes resulting in a desired action; in this particular example, after clicking the SMS button the DanwoodSMS form is opened. It must be noted that a substantial number of computer viruses are written and stored as macros and, when a macro is activated either by pressing the associated button or manually running the code, the virus is released. The whole of the Microsoft Office 2000 suite, which includes Outlook, supports the use of macros. By default, Outlook



has macro security set to medium: “User prompted to enable or disable the macros on a file-by-file basis”. After loading Outlook 2000 and then pressing the SMS button to launch the DanwoodSMS form, the dialogue box in Figure 5.17 is displayed.

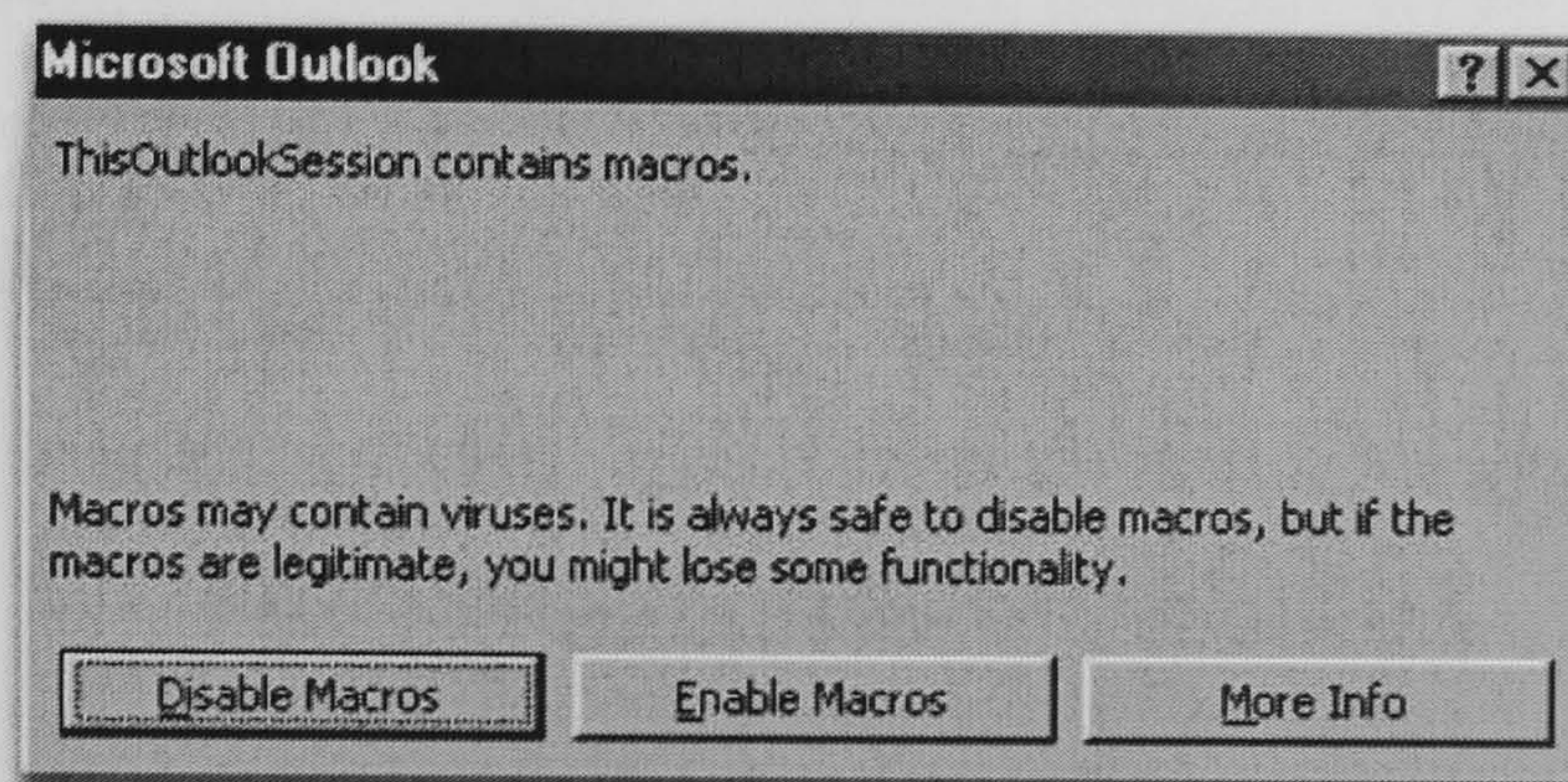


Figure 5.17 – Macro warning message

This occurred each time the user opened Outlook 2000 and when they clicked the SMS button on the tool bar. This was due to the macro security level being set to medium. Having the warning dialogue box displayed each time the SMS button is pressed is extremely irritating for the user and might have discouraged them from using the SMS service.

Setting the security level to low immediately disables all macro security warnings, and macros are allowed to run without questioning the reliability and potential threat of subsequent viruses. Within the Danwood Group this method was not viable because users will at some time receive or indeed create a document that contains macros, whether they are genuine or not.

It was decided to use digital certification to get around the problem of low-level security. A digital certificate is used to certify that the code being used behind a form or other utility is harmless and poses no threat to the users or network security. Outlook 2000 can support the use of digital certificates and can allow only accredited macros to run automatically with security set to medium. Danwood did not require the high-level



accreditation given by external agencies because the short message project was for internal use only and the code written was known to be safe. Office 2000 has a tool called Selfcert that allows developers to create digital certificates and assign them to appropriate code. Figure 5.18 shows the digital certificate that was installed on the employees' machines. With the digital certificate installed, when the user clicks on the SMS icon from the Outlook command bar the DanwoodSMS short message form is displayed without the security dialogue boxes.

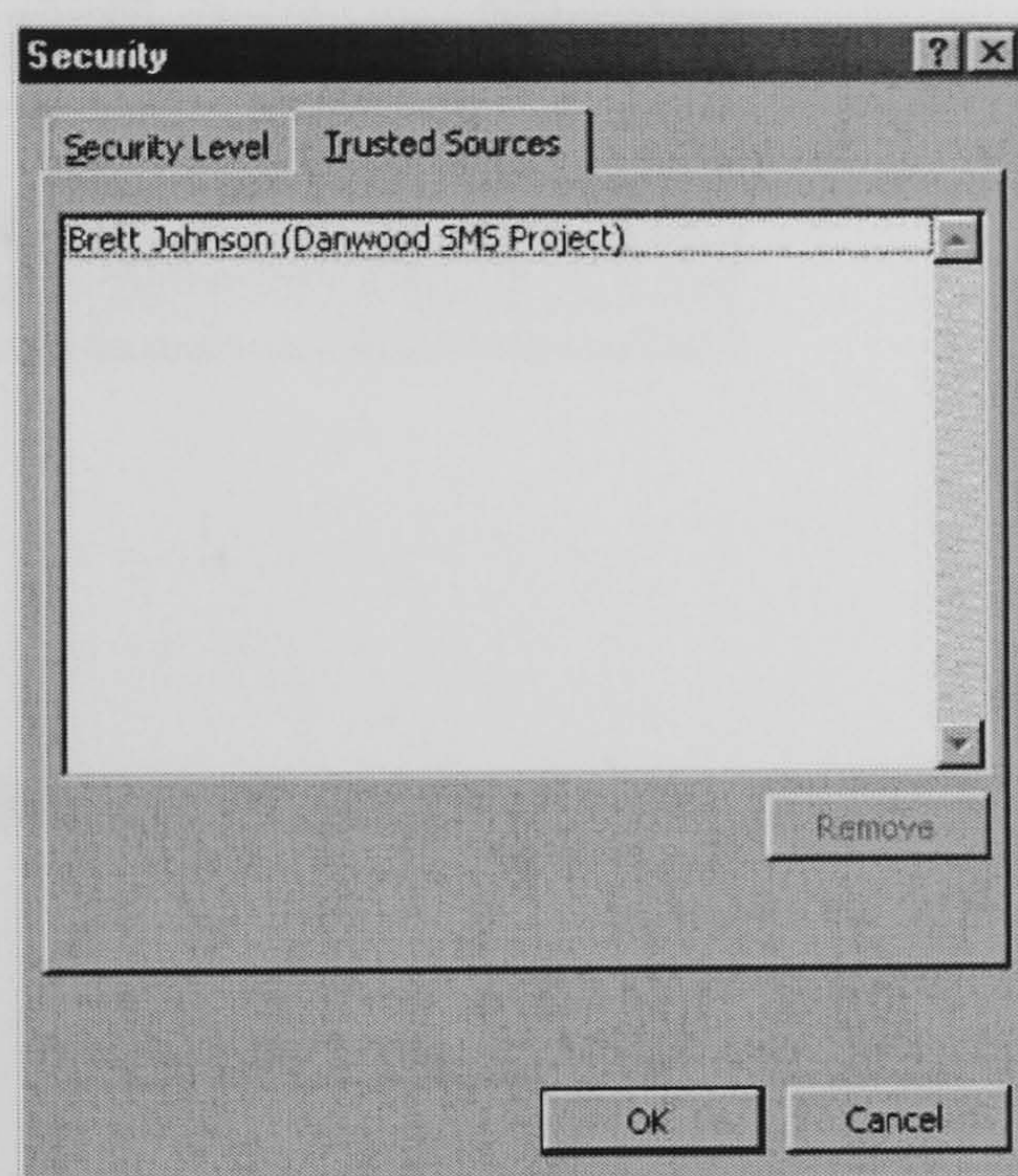


Figure 5.18 - The Trusted Sources

## 5.7 Mobile Phone Analysis

As mobile phone and SMS (Short Message Service) were becoming more established, data had to be captured from the Danwood Group mobile phones to ascertain the volumes of use for both a research and company purposes. The author built an internal billing system, shown by Figure 5.19, for the company, which would create bills for employees who were spending over their predetermined allowance. The specification for the Mobile Phone application can be found in Appendix 11. The application



recorded useful research metrics, for example, the number of text messages sent, the recipient, the time they were sent, the number of mobile phone calls made between certain times of the day, etc.

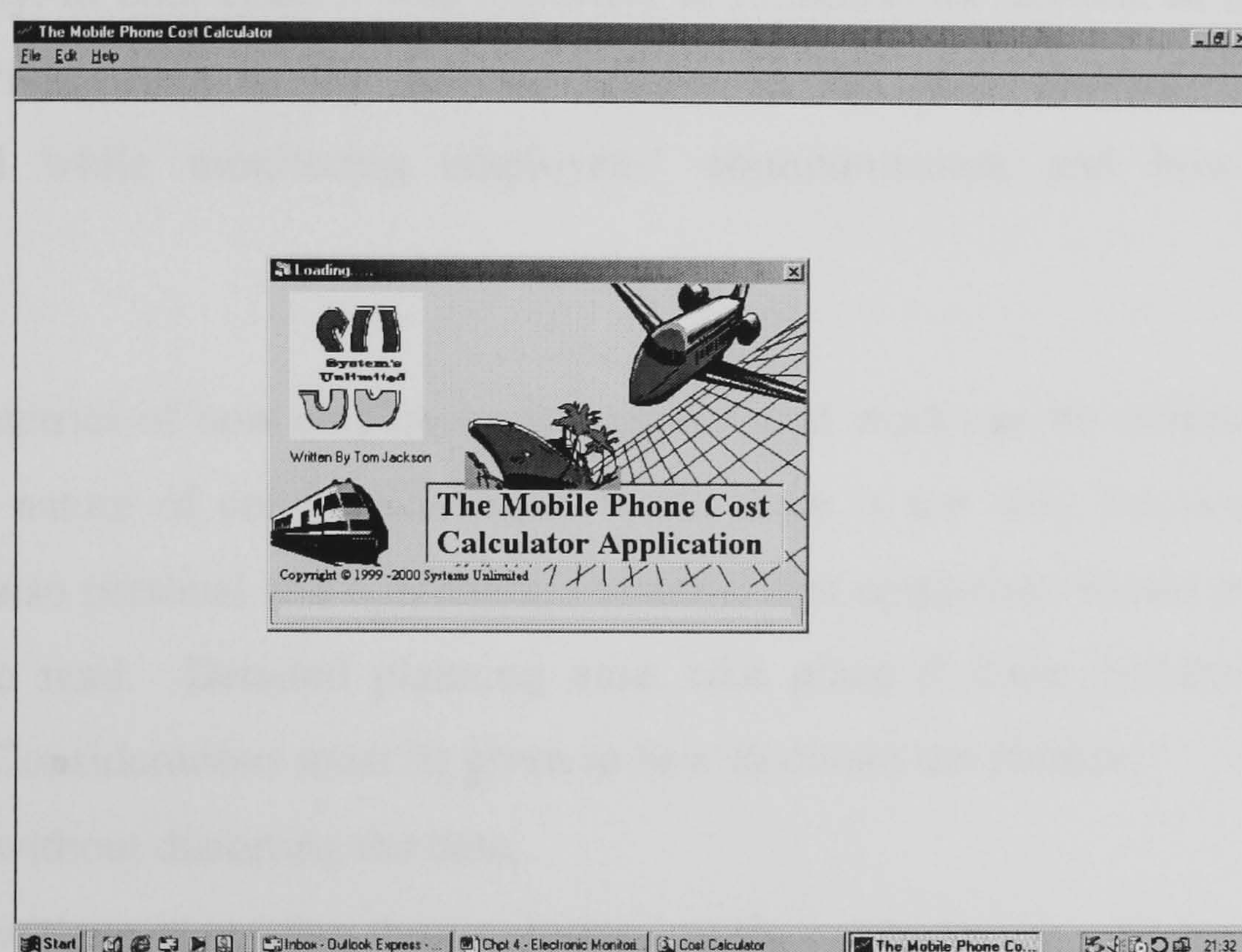


Figure 5.19 – The Mobile Phone Cost Calculator Application

The application works by using a data file called data.txt, which contains information about mobile phone numbers, employee names and the number of minutes they are allowed to use. The application processes the data.txt file along with the disk bill provided by the mobile phone company to produce individual bills. This application was used to carry out the SMS and mobile phone analysis in Chapter 7 and in the paper “Downsizing Electronic Mail Can Optimise Company Communications”, presented at the INSPIRE 2000 conference (Jackson T.W., Dawson R. and Wilson D. 2000). The application has also been frequently used to determine if other mobile phone companies can offer better deals by changing the current phone charges in the set-up menu to the proposed offer.



## 5.8 Conclusion

This chapter has shown the processes involved in both developing software and evaluating off-the-shelf applications used to monitor employee email usage electronically. In both cases it was important to minimise the amount of intrusion into personal privacy due to the adverse affects. It has also outlined the problems encountered while monitoring employees' communication and how they were overcome.

Obtaining metrics of how employees communicate at work can be extremely difficult. Due to the nature of communication at work, there is not only business content in emails but also personal and confidential material that employees would not want their employer to read. Detailed planning must take place if these problems are to be overcome. Considerations must be given to how to obtain the metrics:

- without distorting the data,
- without disrupting the employees' work,
- without losing trust between employees and employers,
- having valid reasons behind gaining the metrics that both the employer and most importantly the employees can understand.

The data captured from the software detailed in this chapter has led to a series of recommendations that will enable companies to make better use of email communication and to increase employee productivity. The overall value of measuring the communication processes through electronic monitoring has been highlighted in the majority of the author's research papers. The analysis of email has enabled the effect on employee time to be quantified, and has given some surprising results which are described in Chapters 6, 7 and 8.



## CHAPTER 6 – ELECTRONIC COMMUNICATION

### Chapter Preface

This chapter is based on the papers, “Improving the Communications Process: The Costs and Effectiveness of Email Compared with Traditional Media”, “E-Communication Analysis: The Cost of an Internal Email Messaging System within Organisations”, “The Cost of Email within Organisations” and “Case Study: Evaluating the use of an Electronic Messaging System in Business” (Jackson T.W., Dawson R. and Wilson D. 1999), (Jackson T.W., Dawson R. and Wilson D. 2000b), (Jackson T.W., Dawson R. and Wilson D. 2000a), (Jackson T.W., Dawson R and Wilson D. 2001).

A cost-benefit analysis exercise of the use of internal email was performed at the Danwood Group. This research has resulted in the creation of an internal email costing process showing when it starts to become a more efficient means of communication.

In this study, the times taken to read, write and perform other functions with email were measured for a sample of employees. The email content was also monitored to determine which emails were business-related. It was found that nearly two-thirds of all emails were non-business-related at the start of the research, but this decreased to a consistent 43% towards the end. This was possibly because the novelty factor of the new email system decreased over time. This chapter concludes that the analysis has been a useful learning experience for the company, showing the value of cost-benefit research and highlighting the difficulties involved. It has also identified the possible benefits that could be obtained by monitoring email systems.

### Chapter Keywords

Email Monitoring, Email Costing Formula, Employee Effectiveness



6.1 Introduction

Email is undoubtedly a versatile communication tool capable of sending a message anywhere in the world within seconds regardless of the time boundaries. Recently email was installed at Whitehall and other British Embassies around the world, speeding up internal channels of communication. Instead of old-fashioned telegrams, email enabled them to pass information more quickly and securely, reducing the amount of paperwork and making them all more effective (Fatchett D. and Hibbs J. 1999).

Email, like any other communication tool, can be used for both personal and business communication. One difference between email and other communication media is that email is more private than the telephone. In a working environment everyone surrounding you can hear your telephone conversation, which makes it harder to use the telephone for personal calls.

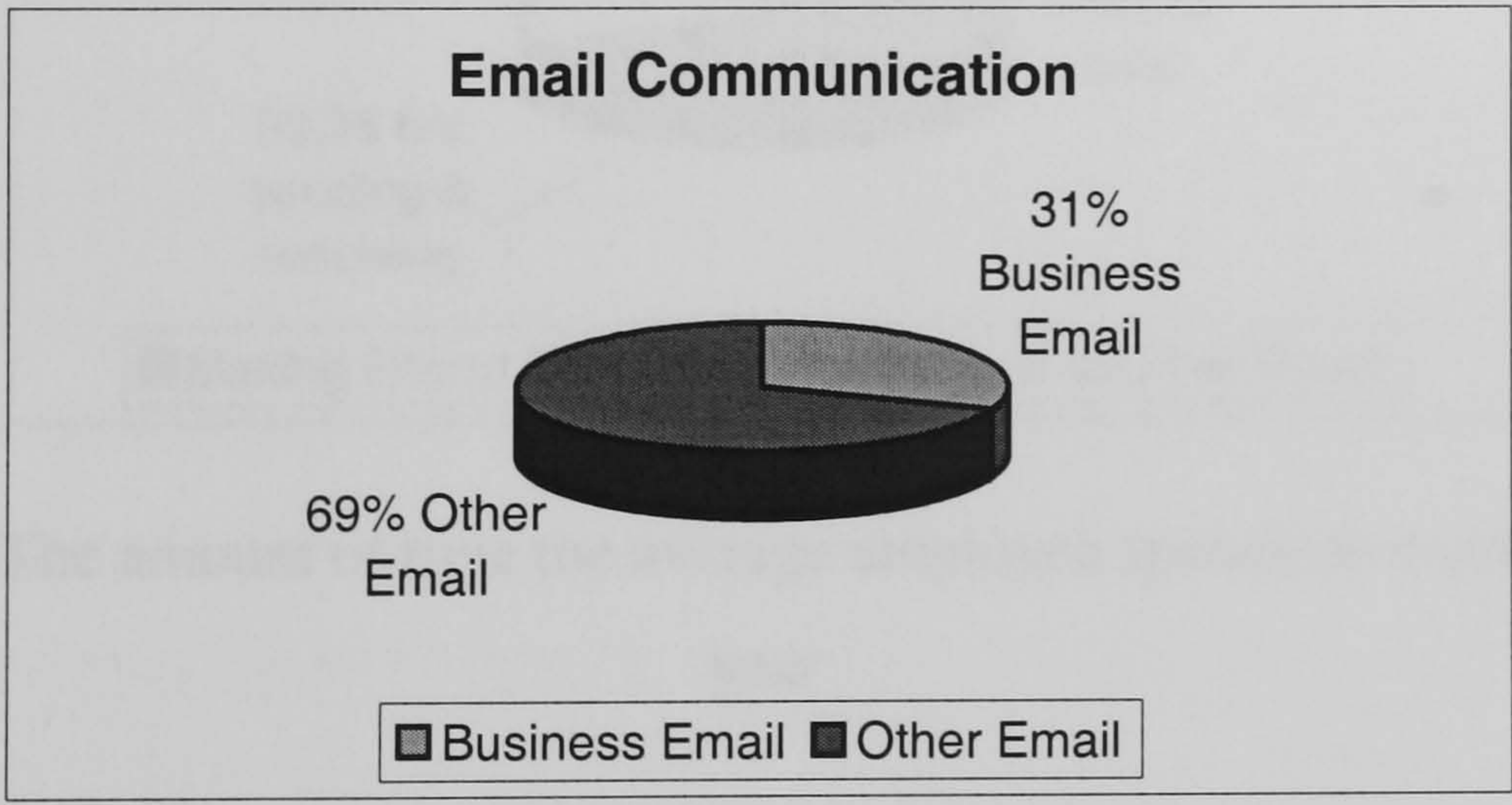


Figure 6.1 – A breakdown of email messages dealt with by the average employee

Analysis of the Danwood Mail metrics, to some readers, will show email is not as productive as first anticipated due to its large non-business usage. As shown by Figure 6.1, the average employee uses email mainly for non-business purposes, for example



sending jokes or telling their colleagues to make the tea. However, sending non-business email doesn't mean it is not productive, as discussed in section 6.5 of this chapter. Reasons behind such high non-business usage of email could be the ease of use and privacy that it offers. Only 31% of the messages dealt with were business related.

Changing the percentages from Figure 6.1 into hours shows that 54.12 hours, in a working year of 48 weeks per average employee, is spent on non-business communication, as shown in Figure 6.2. This means on average an employee spends 14 minutes per day on non-business email. In addition, recovery time has to be added for each interrupt.

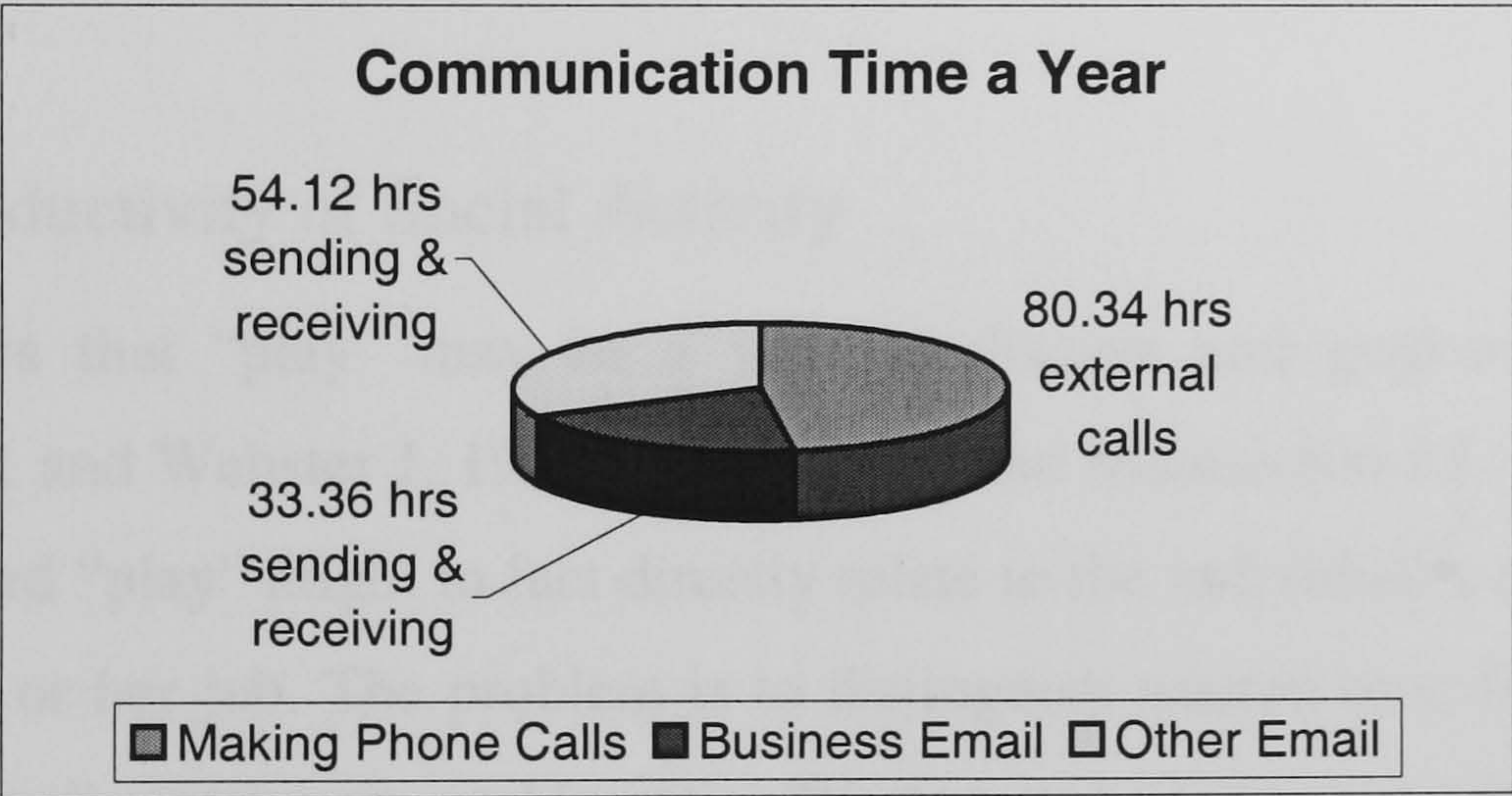


Figure 6.2 –The amount of time the average employee spends on communicating a year

The research carried out on the Danwood Mail shows that the average employee reads 11 non-business emails a day. However, the range of values varies considerably depending on the employee. At the higher end of the scale a minority of employees read 30 emails a day, whilst at the lower end a number of employees do not receive any emails a day.



It was clear after this research that further research was required into how long it takes an employee to recover from an email interrupt, as interrupts could cause the 54.12 hours a year to increase greatly. Research into recovery times after email interrupts was carried out after the stage of research being described in this chapter, and a report on that subsequent work and its results is given in Chapter 8. The extent of the recovery time will inevitably vary from person to person: many employees may react to an incoming email immediately, implying the recovery time is likely to be similar to the recovery time after a phone call for these employees. Other employees may wait until a more convenient moment and then deal with several emails together. This type of reaction will result in a much shorter recovery time. However, even if it takes an average of only one minute to recover from an email interrupt, this nearly doubles the amount of time spent on non-business email and would effectively be giving an employee a further 2 to 3 weeks' holiday a year.

## 6.2 The Productivity of Social Activity

Research shows that “play” may be a very productive and goal-oriented activity (Starbuck W.H. and Webster J. 1991), (Webster J. and Martocchio J.J. 1992). Alleged non-work-related “play” might in fact directly relate to the individual's effectiveness in performing his or her job. The problem is to distinguish wasted time from productive play. Even this distinction is problematic. Wasted time today may be productively applied in the future. Therefore, if the play is exploratory use of software, there should be no issues involved because the play eventually improves the individual's worth to the organisation.

Trying to calculate the effect of non-business email on productivity is difficult. When managers at the Danwood Group first saw the pie charts in Figures 6.1 and 6.2, their reaction was to try to reduce the amount of non-business email to increase employee effectiveness. Though the non-business figures were high, did the amount of non-business email benefit the company in any way? Orr's (1996) research demonstrates,



through the use of case studies, the benefits of learning through social activities (Orr J. 1996). One of the case studies involving sales representatives shows that their social interactions at breakfast, lunch, coffee breaks or even at the end of the day kept each other up-to-date with what they knew, what they learned and what they did. This sociability wasn't simply a retreat from the loneliness of an isolating job. At these meetings, while eating, playing cards and engaging in what might seem like idle gossip, the representatives talked work. They posed questions, raised problems, offered solutions, constructed answers and discussed changes to their work, the machines, or customer relations.

The constant exchanges in which the sales representatives engaged are similar to the useful background updating that goes on constantly in any ordinary work site where people simply become aware of what others are up to because it is evident. The chat usually passes unnoticed unless someone objects to it as "time wasting" — as maybe was the case in the Danwood Group research with the amount of non-business email being read and sent. Though only a fraction may involve directly informing others about explicit business matters, this talk can be valuable. Chatting continuously but almost unnoticeably adjusts a group's collective knowledge and individual members' awareness of each other. This constant chatter is more like the passage of the sun across the sky, a change hard to see directly yet one that continuously reorients people to the progress of the day (Brown J.S. and Duguid P. 2000).

Douglas McGregor (1985) has formulated two models, Theory X and Theory Y, based on the behaviour of individuals at work. These assumptions are based on social science research. They demonstrate the potential which is present in people and which organisations should recognise in order to become more effective. McGregor sees these two theories as two quite separate attitudes. Theory Y is difficult to put into practice on the shop floor in large mass production operations, but it can be used initially in the managing of managers and professionals. McGregor also sees Theory Y as beneficial



to participative problem solving. Theory Y affects the management of promotions and salaries and the development of effective managers.

### **Theory X Assumptions**

- The average human being dislikes work and will avoid it if possible.
- Due to their dislike for work, most people must be forced with the threat of punishment to work towards organisational objectives.
- The average human prefers to be directed, dislikes responsibility, is unambiguous, and wants security above all else.
- These assumptions encourage two forms of managerial principles, the "tough" management approach with punishments and tight controls, and the "soft" management approach which aims at harmony at work.
- Both of these principles do not give the employees the opportunity to fulfil themselves.
- Fulfilment is not permitted by managers adopting the Theory X approach so that behaviour is as expected.

### **Theory Y Assumptions**

- Work is as natural as play or rest.
- People will apply self-control and self-direction in the pursuit of organisational objectives, without external control or threat of punishment.
- Commitment to objectives is a function of the rewards associated with their achievement.
- People learn to accept and to seek responsibility.
- The capacity to use a high degree of imagination, creativity, and ingenuity in solving organisational problems is widely distributed in the population.
- People have potential.



Theory X and Theory Y can be applied to the non-business use of email within the organisation. It is part of the manager's job to exercise authority, and there are cases in which this is the only method of achieving the desired results if subordinates do not agree that the ends are desirable. However, in situations where it is possible to obtain commitment to objectives, it is better to explain the matter fully so that employees grasp the purpose of an action. If Theory Y principles are introduced into an organisation, the amount of non-business email an employee deals with is dependent on the employee and on what the employee feels is acceptable usage. If the amount of non-business email is treated as social networking which is helping to build a community, then the amount of time spent on non-business activities need not be a waste. Though our tendency is to shut ourselves away and sit in isolation when we have to learn, learning is a remarkably social process. Social groups provide the resources for their members to learn. Other socially-based resources are also quite effective, such as email communities (Brown J.S. and Duguid P. 2000). The approach of explaining objectives to employees could be applied to the use of an email system, where the organisation can explain the effects of email interruptions throughout the day and how a reasonable amount of non-business email is good for social networking. Employees will then exert self-direction and control to do better work, quite possibly by better methods than if they had simply been carrying out an order which they did not fully understand (for example, not touse the email system for non-business purposes). The situation in which employees can be consulted is one where the individuals are emotionally mature and positively motivated towards their work, where the work is sufficiently responsible to allow for flexibility, and where employees can see their own position in the management hierarchy. If these conditions are present, managers will find that the participative approach to problem solving leads to much improved results compared with the alternative approach of handing out authoritarian orders (McGregor Douglas. 1985).

In making the distinction between explicit and tacit, Polanyi (1996) argues that no amount of explicit knowledge provides you with the tacit. They are two different



dimensions of knowledge, and trying to reduce one to the other is a little like trying to reduce a two-dimensional drawing to one dimension. This claim of Polanyi's resembles Ryle's (1949) argument that "know that" doesn't produce "know who" and Bruner's (1966) that "learning about" doesn't on its own allow you to learn to be. Information, all these arguments suggest, is on its own not enough to produce actionable knowledge. Practice too is required, and for practice it is best to look to a community of practitioners; one way to achieve this is through building a community via email communication.

There is a clear need for non-business email, but it is less clear at what level it starts to become less productive. Most things in moderation are beneficial to the cause. At the beginning of the Danwood Group research, 69% of the emails dealt with were non-business-related, which worked out to be a total of 14 minutes per employee per day. That proportion was too high and required careful reduction to achieve a better balance between non-business and business communication.

### 6.3 Increasing Communication Effectiveness

In order to make email more effective, the 69% of emails that were non-business needed to be reduced to save some of the 14 minutes plus recovery time lost per employee per day. This would save a medium-size company, of approximately 500 employees, 28000 hours a year on non-business communication even before recovery time is taken into account.

Trying to reduce the amount of non-business email can be difficult and can become very controversial. The email privacy issue came to light recently when employees discovered that employers were reading their email. In one case, when an employee of Pillsbury sent what he thought was a private email communication to a co-worker, labelling Pillsbury as "back-stabbing bastards", he was fired for "inappropriate and unprofessional comments" (Berghel Hal 1997).



Some companies are becoming increasingly concerned about their email being used for non-business purposes and have started to introduce email policies. The following are examples.

*Intel.* Email is monitored to ensure that employees are not engaging in personal activities in company time.

*Kmart.* All email messages are subject to review. Personal use of email is considered a breach of company resource policy, possibly resulting in denied access to the company computer system or in termination.

*Epson.* Email is considered company property, and is subject to review, printing, storage and dissemination by management.

Other companies, such as Apple, have no corporate policy.

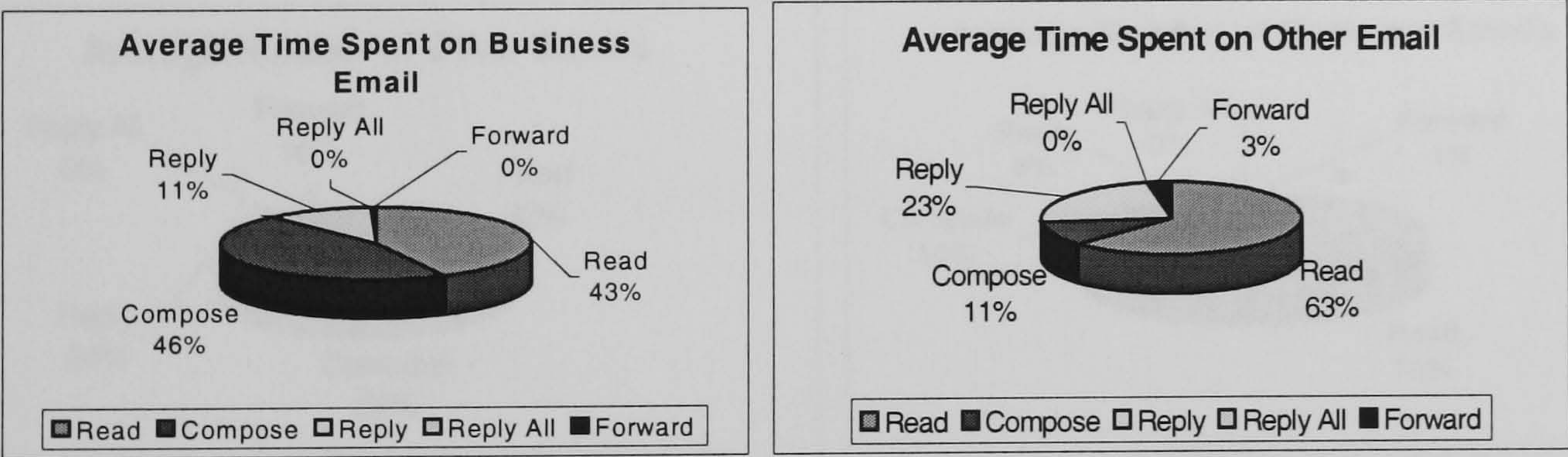


Figure 6.3 & 6.4 –Breakdown of time spent on Email Activities  
(6.3 – business / 6.4 – other)

Figures 6.3, 6.4, 6.5 and 6.6 show that the patterns of use for non-business email are quite different to those for business email. Figure 6.4 shows that employees spend more time reading a typical non-business email, and are far more likely to reply or forward the message to others. If an employee spends 2 minutes composing a non-business-related email, Figure 6.4 shows that this represents only 11% of the time lost;



the remaining 89% or 16 minutes is lost in reaction time by the receivers of the email plus any additional recovery time taken.

Trying to track down the employees that produce a high volume of non-business email is not straightforward. With mailing groups becoming increasingly popular, sending email to large numbers of people should result in employees receiving many more emails than they send. While Figure 6.5 shows that this is the case for business-related emails, Figure 6.6 shows that the number of non-business emails read is comparable to the number sent, implying that mailing groups are not frequently used for non-business purposes. This implies that the non-business emails are targeted more at particular employees who are, presumably, more amenable to receiving such email. This will make it difficult for an employer to be even aware that such emails are being sent, let alone know the extent of such email use. The only way for an employer to be able to detect the level of non-business use is to monitor the content of the emails, but this comes with the risk of employee unrest over the loss of privacy that it would entail.

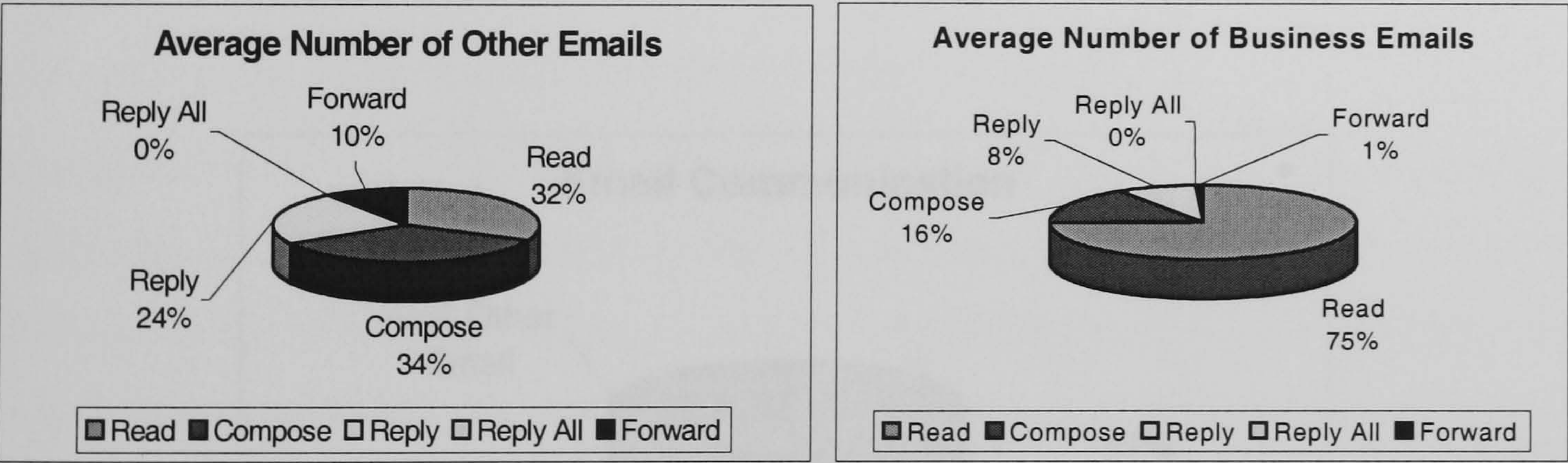


Figure 6.5 & 6.6 –Breakdown on average number of Email Activities

(6.5 – business / 6.6 – other)

After the initial findings of high non-business email usage, Danwood considered the introduction of a stronger email policy to try and reduce this. They decided against the new policy, as there were signs of a natural reduction in non-business email. With



more employees using the messaging system for business, and the high-volume non-business email users reducing the amount of non-business email, there was a natural reduction in non-business email.

At the start of the research study, 69% of the emails dealt with were non-business-related, though after time that figure decreased, to the level shown in Figure 6.7. A possible reason for the decrease in non-business email could be that, when the research into email usage started, the new email facility was still novel to employees. Over time the novelty decreased and the amount of non-business email decreased because of this. The amount of non-business email, shown in Figure 6.7, has been at a consistent level, around 43%, for several months, and the author believes that this level of non-business email will not change unless an email policy or a different email application is introduced. The metrics show that email is not as effective as first anticipated. At the beginning of the research, 33 hours a year (Figure 6.8), or alternatively only 31% of the messages dealt with, were business-related, but this has increased in time reaching a consistent level of around 57% (Jackson T.W., Dawson R. and Wilson D. 1999).

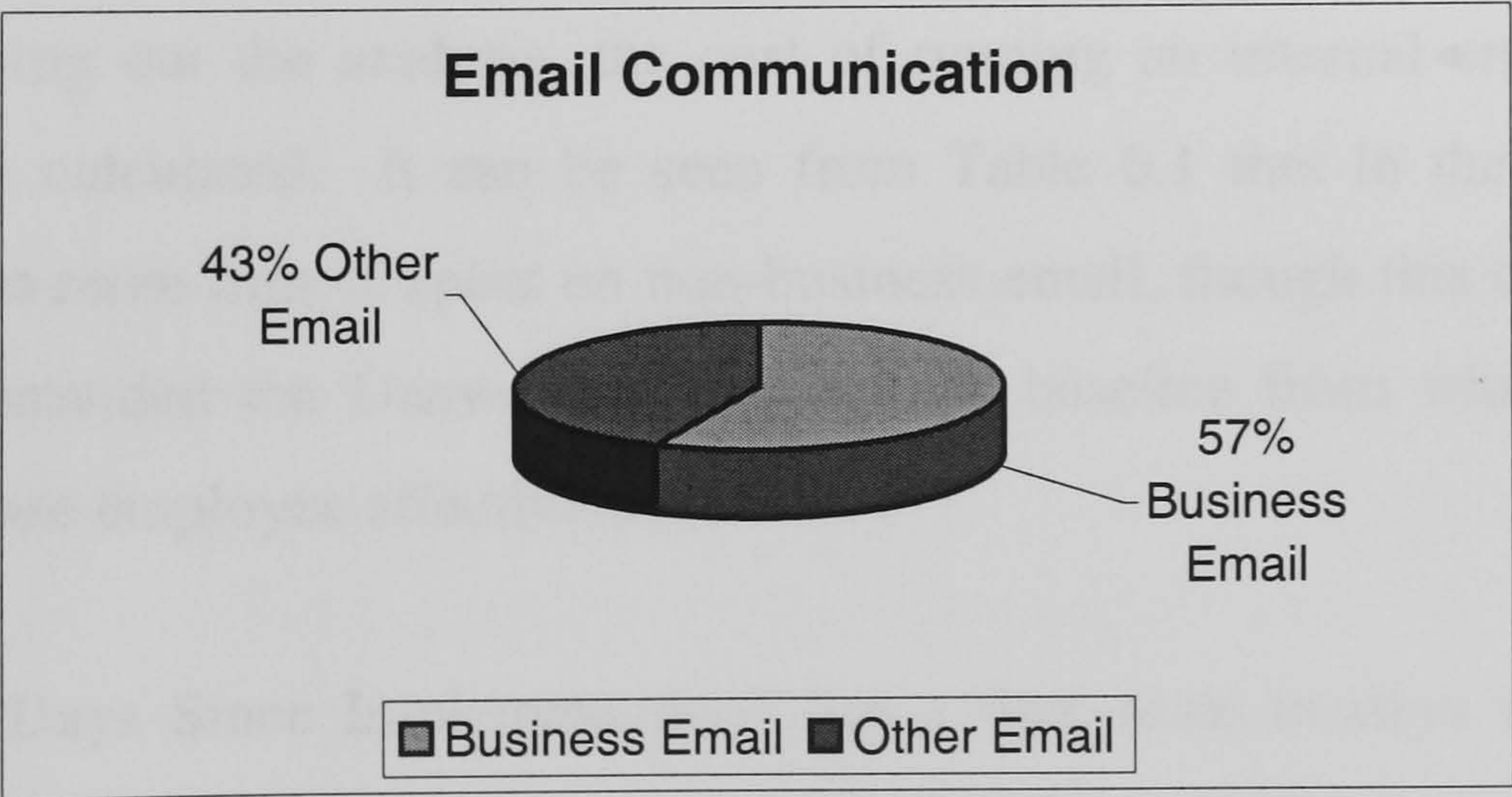


Figure 6.7 – A breakdown of email messages dealt with by the average employee in a developed email system



At the beginning of the research 10 out of the 15 emails received a day were non-business-related, but this decreased over time to 7 out of the 17 emails received a day being non-business related.

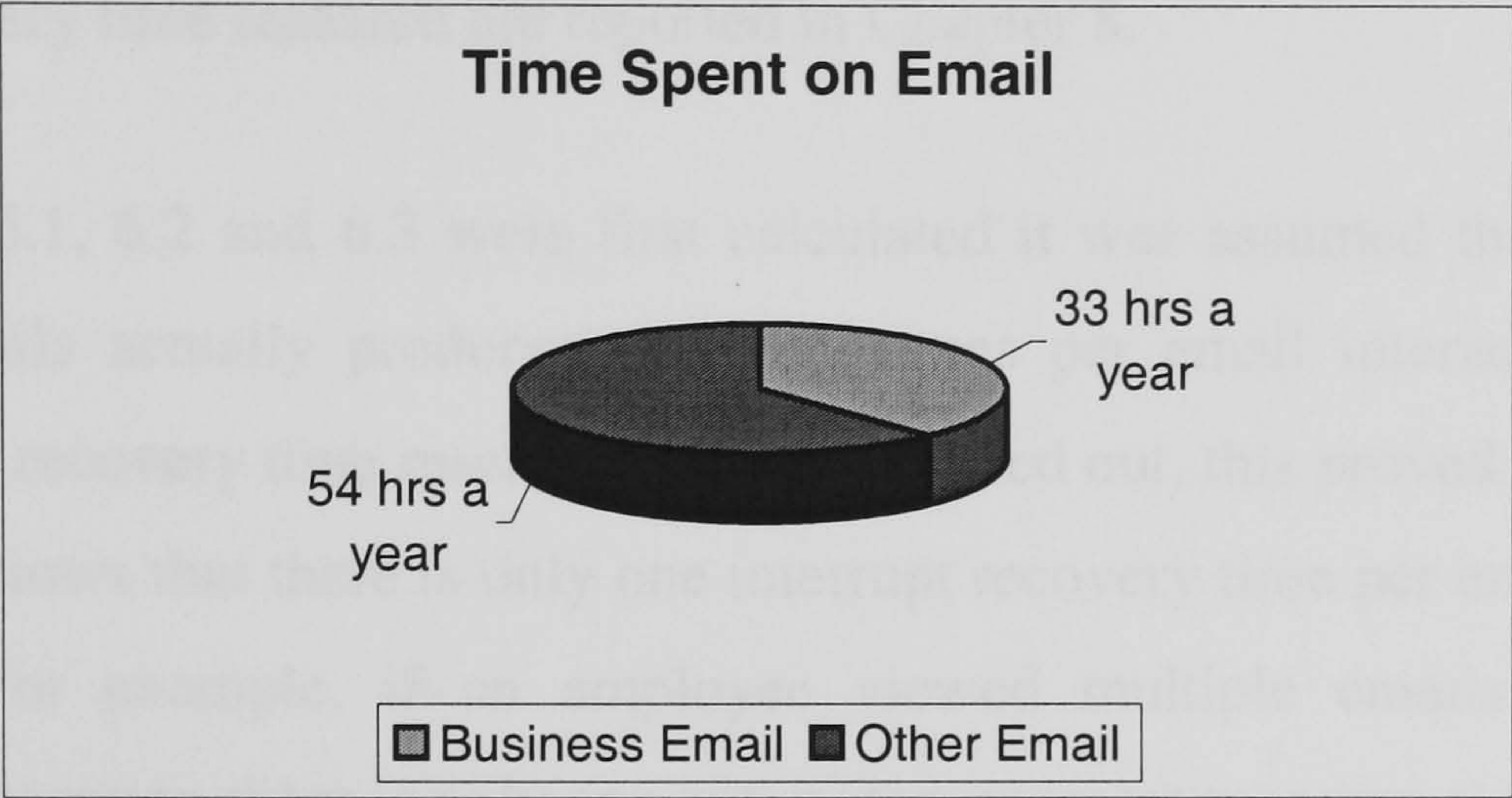


Figure 6.8 –The amount of time a year the average employee spends on communicating on a newly established email system

6.4 The Cost of Running an Internal Email System

Through carrying out the analysis, the cost of running an internal email messaging system can be calculated. It can be seen from Table 6.1 that in the early days of implementation more time is spent on non-business email, though this decreases. The analysis has provided the Danwood Group with a baseline from which to work in trying to increase employee effectiveness.

The column “Days Since Implementation” has a time-scale in days from when the internal email messaging system was implemented within an organisation. The column “Other Email a Day” denotes how long an employee spends on non-business email a day depending on how long the email system has been implemented. The column “Business Email a Day” denotes how long an employee spends on business email a day depending on how long the email system has been implemented.



When these Tables 6.1, 6.2 and 6.3 were first published, the recovery time of an email interrupt was not known and was estimated to be 1 minute. Subsequently the author carried out research into email interrupt recovery times and discovered that, on average, it takes 64 seconds to recover from an email interrupt. The results of the interrupt recovery time research are reported in Chapter 8.

When Tables 6.1, 6.2 and 6.3 were first calculated it was assumed that dealing with individual emails actually produced recovery times per email interaction. After the email interrupt recovery time research had been carried out, this proved to be incorrect. The research shows that there is only one interrupt recovery time per email application interruption. For example, if an employee viewed multiple emails in one email application transaction there is only one associated interrupt recovery time. However, if an employee viewed three emails over two email application interactions, this would incur two interrupt recovery times. With the subsequent research into email interrupt recovery times it is harder to re-evaluate Tables 6.1, 6.2 and 6.3 to a per interrupt figure, as the data previously collected cannot accurately determine the number of email application interactions. However, the tables still provide an indication of the cost of using an internal email system, and they assume the worst scenario of an employee viewing only one email at a time in an email transaction.

The “Days Since Implementation” intervals have been chosen in relation to how many total minutes are spent on email a day. When analysing all of the collected data for Table 6.1, the results presented three main intervals in terms of “Total Minutes a Day”. The “Other Email” or “Business Email” intervals could have been analysed and used to create the “Days Since Implementation” intervals, but these were only part of the minutes spent on email and not the total minutes spent using the email system. A gap of 0.95 minutes was chosen for the time intervals for column “Total Minutes a Day”, which led to “1 to 39 days”, “40 to 84 days” and “85 days plus” being used for the “Days Since Implementation” column.



Days Since Implementation	Other Email a Day	Business Email a Day	Total Minutes a Day
1 to 39 days	13.53 minutes	8.34 minutes	21.87
40 to 84 days	10.98 minutes	11.84 minutes	22.82
85 days plus	8.43 minutes	15.33 minutes	23.76

Table 6.1 – Breakdown of time spent by an average employee on Email a day without Recovery Time

6.4.1 Cost of Other Email

Days Since Implementation	Other Email a Day	Estimated Recovery Time	Total Minutes a Day
1 to 39 days	13.53 minutes	14 minutes	27.53
40 to 84 days	10.98 minutes	11 minutes	21.98
85 days plus	8.43 minutes	8 minutes	16.43

Table 6.2 – A breakdown of time spent by an average employee on Other Email and Estimated Recovery Time a day

Using Table 6.2 in conjunction with the Formula 6.1 below, it is possible to calculate the current cost of non-business email. To illustrate the level of costs that can be incurred by an email message system, the formula will be applied to a medium-sized company with 120 employees with an average wage of £320 per week, with an assumed overhead also of £320 per week. In this company the email system was installed over a year ago, so therefore the formula will use figures for “85 days plus” since implementation.



$$\textit{Total Minutes} * \textit{Email users} * \textit{Average Employee Wage per minute} = \textit{Cost per day}$$

#### Formula 6.1 – Current Cost of Non-Business Email

The cost to the company per day for 120 employees to use the internal email system for non-business purposes is £525. The cost to the company for the year is over £126,000. These figures are calculated as follows.

**£525 for 120 employees a day** = 16.43 minutes a day \* 120 email users \* (average wage £320 per week + overhead of £320 per week / (40 hours \* 60 = 2400 minutes a week))

**£126,000 for 120 employees for a year** = 5 days \* 48 working weeks \* £525

The “Cost per day” Formula 6.1 only represents the “hard” costs to an organisation and does not take into account the “soft” costs. The “hard” costs are easier to calculate than the “soft” ones because they normally involve predetermined measurements, for example employee time and wages per employee. However, “soft” costs are not so easy to calculate and measure, as it is difficult to determine the cost-benefit, for example, of having non-business email or of being able to share information with multiple employees at the touch of a button instead of using the phone. Even though Formula 6.1 can only calculate the “hard” values of an email system, however, it is still an important calculation to make, as businesses are usually not aware of the costs involved in using an email system. The “hard” costs will gain the attention of managers and directors alike, but it is important that the potential “soft” costs are also highlighted with reference to the potential benefits that the “soft” values might bring to an organisation. However, more research is required within the area of “soft” cost/values to determine the benefits and the drawbacks.



6.4.2 Cost of Business Email

Days Since Implementation	Business Email a Day	Estimated Recovery Time	Total Minutes a Day
1 to 39 days	8.34 minutes	8 minutes	16.43
40 to 84 days	11.84 minutes	12 minutes	23.84
85 days plus	15.33 minutes	15 minutes	30.33

Table 6.3 – A breakdown of time spent by an average employee on Business Email and Estimated Recovery Time a day

The cost of business email can be calculated in the same way as non-business email. Again to illustrate the level of costs that can be incurred by an email message system, Formula 6.1 will be applied using Table 6.3 to a medium-sized company. The company has 120 employees with an average wage of £320 per week and an assumed overhead also of £320 per week. Again, like the previous example, the company has a mature email system and therefore the formula will use figures for “85 days plus” since implementation.

*Business Email minutes \* Email users \* Average Wage per Minute = Cost per day*

Formula 6.2 – Current Cost of Business Email

The cost to the company per day for 120 employees to use the internal email system for business purposes is £970. The cost to the company for the year is more than £220,000.

These figures are calculated as follows.

**£970 for 120 employees per day** = 30.33 minutes a day \* 120 email users \* (average wage £320 per week + overhead of £320 per week / (40 hours \* 60 = 2400 minutes a week))



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**£ 220,000 for 120 employees for a year = 5 days \* 48 working weeks \* £970.**

#### 6.4.3 *Cost per Day of Running Email*

The formula below can be used to calculate the joint cost of using the internal email system for both business and non-business activities. Again to demonstrate the cost of running the system, the figures used to calculate the cost of non-business and business emails will be used.

$$\begin{aligned} & (Total\ Non-Business + Business\ Minutes) * Email\ Users * Average\ Wage\ per\ Minute \\ & = Cost\ per\ day \end{aligned}$$

#### Formula 6.3 – Current Cost of Running Email for a Day

The cost to the company per day for 120 employees to use the internal email system is over £1,500. The cost to the company for the year is over £360,000. These costs exclude the cost of hardware, software and maintenance, and only include the cost of employee interaction with the email application and the recovery time associated with the interruption.

These figures are calculated as follows.

**£1500 for 120 employees a day = (16.43 non-business minutes a day + 30.33 business minutes day) \* 120 email users \* (average wage £320 per week + overhead of £320 per week / (40 hours \* 60 = 2400 minutes a week))**

**£360,000 for 120 employees for a year = 5 days \* 48 working weeks \* £525.**

#### 6.4.4 *Cost of Running External Email*

Little research has been carried out into calculating the costs of using the external email system. Initial research carried out so far by the Danwood Group shows that 73% of



these emails are non-business-related, though further research is required to confirm the figure.

## 6.5 Conclusions

The advantage of email is that the electronic medium lends itself to measurement, upon which companies can then act to produce usage policies and to provide education to try and reduce wasted time and improve employee effectiveness. The study has already increased the understanding of the use of IT within the Danwood Group, and has shown both the value of obtaining metrics on their activities and the difficulties involved. The company has also learned that IT should not simply be evaluated in isolation, but as an integrated part of the company processes. It must be studied in conjunction with the effects on the surrounding people and environment.

Through carrying out the analysis, the cost of running an internal email messaging system can be calculated. It has been shown that in the early days of implementation more time is spent on non-business email, though this decreases over time. Even though the email costing formula only calculates the “hard” costs involved in using an email system, it is useful in highlighting the costs involved in communicating.

Being able to record email metrics has enabled a better understanding of how and why employees use email. This initial email study into obtaining usage metrics led to further research into improving the structure of email through one-line emails and establishing the recovery times for an email interruption, which are discussed in Chapters 7 and 8.



## CHAPTER 7 – SHORT MESSAGING

### SERVICE FOR EMAIL

#### **Chapter Preface**

This chapter is based on the “Downsizing Electronic Mail can Optimise Company Communications” paper, which was presented at the Inspire conference in September 2000 (Jackson T.W., Dawson R. and Wilson D. 2000b). The introduction of electronic communication in companies has many claimed benefits. One such benefit is that this communication lends itself to measurement and monitoring. The findings at the Danwood Group have shown that many messages could be conveyed in a single line of text as is now currently done in mobile phone text messages. A new email add-on was developed for the Danwood Group to take advantage of single-line emails, giving a service that would send one-line messages with high priority and display each message in the receiver’s Inbox. This was found to be a time-saving service, which also led to more structured email messages. It is concluded that the introduction of a short-message email service has been of benefit to the Danwood Group and that other companies would similarly benefit if email service providers incorporated a short-message facility into their software.

#### **Chapter Keywords**

SMS, Short Email Message

#### **7.1 Introduction**

This chapter introduces a new type of communication for computer-based email called Short Message Service (SMS) messaging. This is a short form of email-based on the SMS facility for mobile phones. The new communication format was introduced for computer users at the Danwood Group, to see if the amount of time an employee



spends on email can be reduced and whether the email becomes more structured through using the new tool. The empirical data collected for the chapter compares the two different communication media, computer email and mobile phone SMS, to see if there are any similarities in behavioural patterns and to see what can be learnt from mobile phone communication.

Research carried out by the author in Chapter 6 and Chapter 8 (Jackson T.W., Dawson R. and Wilson D. 2000c), measured the times taken to read, write and carry out other functions within email and the time it takes to recover from an email interrupt, for a sample of employees. An informal observation in this research suggested that 50% of emails communicated could be handled in a one-line message. Further research carried out by the author (Jackson T.W., Dawson R. and Wilson D. 2000a) showed non-business email within the company was around 43% (as discussed in Chapter 6) out of the total email dealt with by each employee. This level of non-business email is unlikely to change unless an email policy or a different email application is introduced. Following this research a pilot exercise was set up at the Danwood Group, to investigate the effects of using SMS via the current email system to increase communication efficiency and to reduce the amount of time spent on non-business email.

The objective of the project was to develop an internal SMS, which could be accessed through Outlook 2000. The short message activity was monitored and the results collated to see whether the Short Message Service had increased the effectiveness of communicating within the workplace, by reducing the time spent composing and reading emails.

The SMS application was developed as an add-on for Outlook 2000 using the development features available within Outlook 2000 and Visual Basic for Applications (VBA). The Outlook 2000 add-on resulted in the Danwood Group employees having the ability to send a short message as an alternative to a traditional email message.



## 7.2 Could Less be More?

As mentioned in Chapter 1, historians frequently trace the beginnings of the information age not to the Internet, the computer, or even the telephone, but to the telegraph. With the telegraph, the speed of information essentially separated itself from the speed of human travel, which was then the speed of the train. In comparison the telegraph could carry information close to the speed of light. Nowadays, because it is easy to send information across the LAN (Local Area Network) and WAN (Wide Area Network) not much thought is given to what is being sent. If the user still had to travel by train to deliver the information, greater care and consideration would undoubtedly be taken in preparing the content of the information to be sent.

Few people really want to abandon information technology. Hours spent in a bank line, when the ATM (Automatic Teller Machine) in the supermarket can do the job in seconds, have little charm. Lose your papers in a less-developed country and trudge, as locals must do all the time, from line-to-line, from form-to-form, from office-to-office, and you quickly realise that life without information technology, like life without modern sanitation, may seem simpler and even more “authentic”, but for those who have to live it, it is not necessarily easier or more pleasant.

Even those people who continue to resist computers, faxes, email, personal digital assistants, let alone the Internet and the World Wide Web, can hardly avoid taking advantage of the embedded microchips and invisible processors that make phones easier to use, cars safer to drive, appliances more reliable, utilities more predictable, toys and games more enjoyable and trains run on time. Though any of these technologies can undoubtedly be infuriating, most people who complain want improvements, not to go back to life without them (Brown J.S. and Duguid P. 2000).

However, it is difficult to satisfy the complainers, because to improve or to make a technology more efficient normally results in change, which the majority of end users dislike and resist. In trying to make less seem more, the SMS email research



undertaken at the Danwood Group resulted in the end user having the option to send either a traditional email or a one-line email that had to be concise and to the point and written in only one line. If employees are persuaded to use the one-line email system then less could easily mean more, as the message is very short and requires detailed structuring compared to a traditional email message.

The majority of employees go about their work unaware that depending on the tool they choose for communication could mean that less means more. Instead employees rely on the general phenomenon of compensatory adaptation, which consistently surfaces when people are faced with the need to use communication technology which is perceived as "inadequate" to support discussion related to a given task. Compensatory adaptation in non-face-to-face communication will result in clear and consistent behavioural modifications aimed at compensating for media inadequacies, which in some cases may result in the inadequacies being partially overcome and the outcomes of the communication being better than in equivalent face-to-face meetings. Compensatory adaptation behaviour will take place independently of gender, ethnicity, department, and native language composition in non-face-to-face meetings (Kock N. 2000).

The SMS tool developed for the research at the Danwood Group not only adds another way of communicating for the employees, which could lead to compensatory adaptation, but it also develops the employees' skill in structuring emails and writing precise messages. The skills learnt from using the SMS tool by the employees could be used in other communication methods.



7.3 The Mobile Phone and SMS Messaging

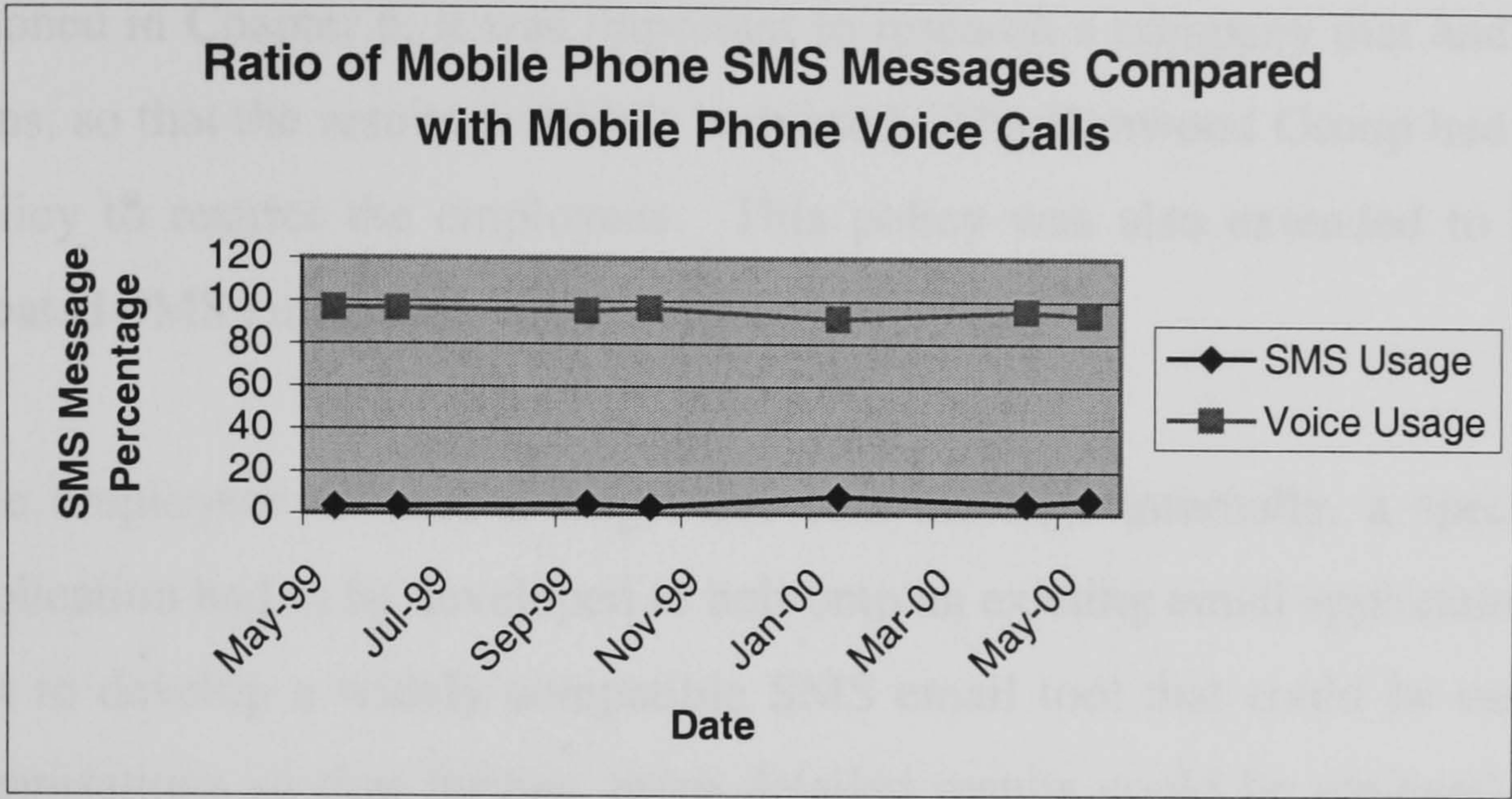


Figure 7.1 – Ratio of Mobile Phone SMS Messages Compared with Mobile Phone Voice Calls

As the mobile phone SMS has become more established, data has been captured from the Danwood Group mobile phones to ascertain the volume of use within its traditional context. Information was obtained from 140 mobile phone users, over a six-month period. The information was captured using the Mobile Phone Cost Calculator Application written by the author specifically for the Danwood Group. How the Mobile Phone Cost Calculator Application was written is detailed in Chapter 5. The application recorded many different kinds of metrics so that a comparison could be made between the traditional use of SMS on a mobile phone and the new type of SMS via the email system. Comparisons were also made with voice communication on mobile phones and traditional computer email. Figure 7.1 shows the percentage of mobile SMS messages and the percentage of mobile phone calls as a proportion of the total number of communications by mobile phone. The balance of traditional voice messaging compared with the new SMS for mobile phone users shown in Figure 7.1 may be an indication of the likely balance of usage of the traditional email system relative to the new email SMS system for computer users. The metrics on the usage of the mobile phone SMS system showed it was a minority of employees that actually used the facility.

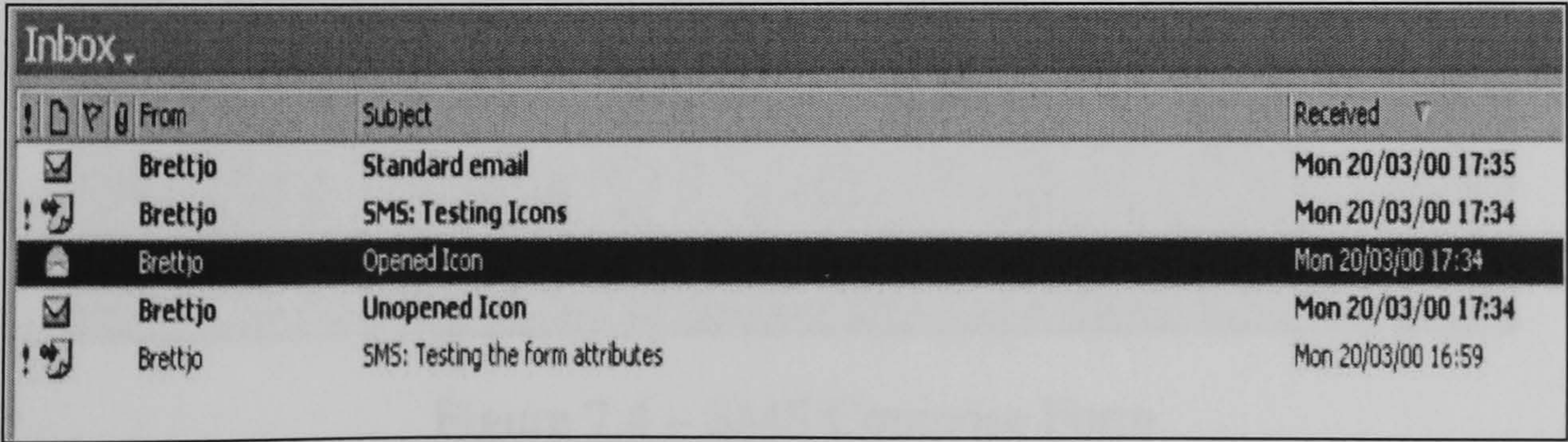


7.4 Planning the Development of the SMS Email Tool

As mentioned in Chapter 6, it was important to research a company that had no email restrictions, so that the results wouldn't be biased. The Danwood Group had no direct email policy to restrict the employees. This policy was also extended to using the newly created SMS email tool.

To enable employees to send a single-line text message internally, a specific SMS email application had to be developed to bolt onto an existing email application. It was important to develop a widely compatible SMS email tool that could be used within other organisations so that further, more detailed results could be obtained. One of Danwood Group's IT plans for the year was to replace their current email application with the latest Microsoft email client software Outlook 2000. As Outlook is used by a majority of organisations, the SMS email tool was built as an add-on to Outlook 2000.

For the SMS email research programme to be a success the potential users needed some incentive to use the new system. For message senders, the incentive was that their messages automatically had high priority. For the receiver the message was displayed in the Inbox list of messages, eliminating the need to "open" each individual message (see Figure 7.2). It was also imperative that the short message service was seamless and acted as an integral part of Outlook 2000. If the SMS service were difficult to use then the users would resort to sending traditional emails.



Inbox			
	From	Subject	Received
<input checked="" type="checkbox"/>	Brettjo	Standard email	Mon 20/03/00 17:35
<input checked="" type="checkbox"/>	Brettjo	SMS: Testing Icons	Mon 20/03/00 17:34
<input checked="" type="checkbox"/>	Brettjo	Opened Icon	Mon 20/03/00 17:34
<input checked="" type="checkbox"/>	Brettjo	Unopened Icon	Mon 20/03/00 17:34
<input checked="" type="checkbox"/>	Brettjo	SMS: Testing the form attributes	Mon 20/03/00 16:59

Figure 7.2 – Outlook 2000 Inbox with SMS and Traditional Email Messages



7.5 Functionality of the SMS Email Tool

When creating the SMS email tool the amount of functionality to be included was an important consideration. The tool had to include the right balance of functions, so that the user would find the tool useful but also not too difficult to operate. The following functionality was built into the SMS email tool.

- The SMS email tool can be easily accessed through an icon on the Outlook 2000 tool bar (see Figure 7.3).

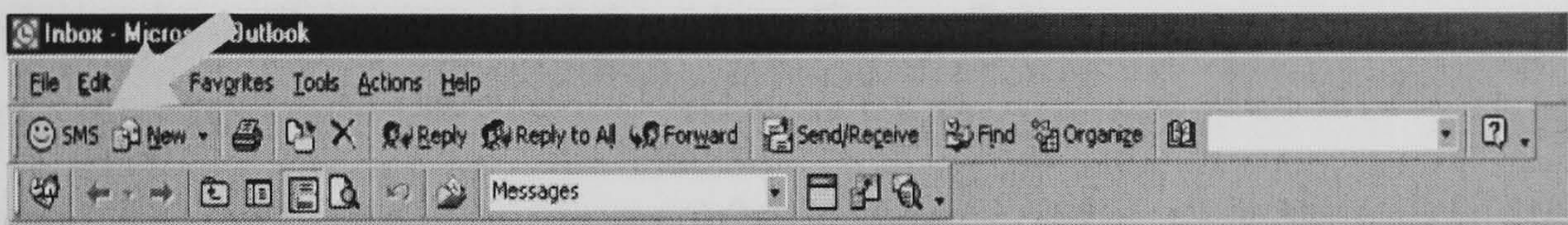


Figure 7.3 – Outlook 2000 Icon Tool Bar with the SMS Icon

- The text formatting toolbar was removed to reduce functionality and to emphasise the use of a quick short message rather than a fancy formatted message.
- A prefix, “SMS:”, is automatically included to illustrate to the recipient that a short message follows (see Figure 7.2 and Figure 7.4).

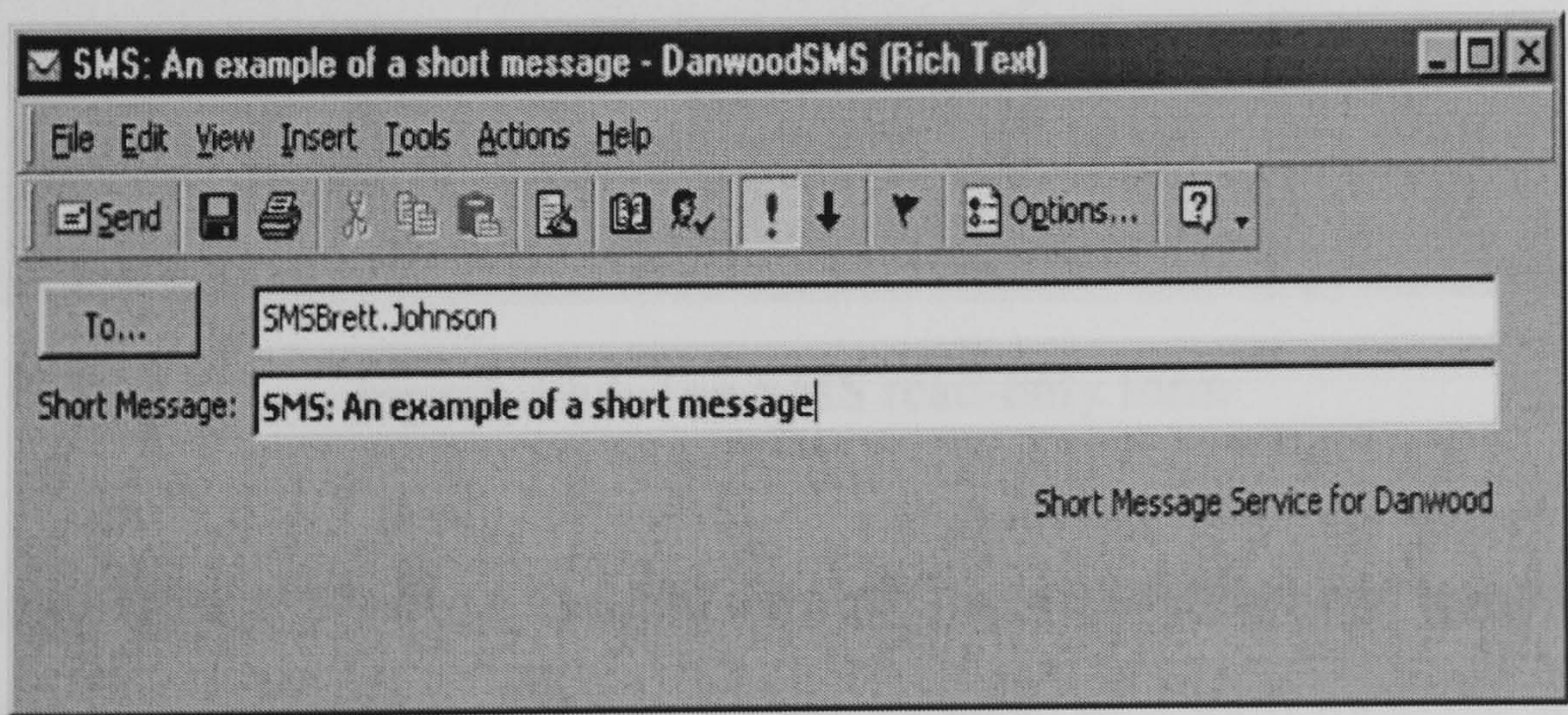


Figure 7.4 – SMS Compose Form



- The message priority is set to “high” to encourage the sender to use the service and to attract the receiver’s attention in the user’s Inbox. This is shown by a “!” symbol which can be seen in Figure 7.2.
- The “subject” text box has been removed, as this was not necessary: the objective was to be able to send a quick short message, and allowing users to specify the subject matter is unnecessary when sending a short message (see Figure 7.4).
- When a traditional email is received, the icon of an unopened envelope is displayed next to the unread email. However, with a short message the icon has been changed to a “Post-it” icon, further emphasising the difference between a short message and a traditional email in a user’s Inbox (see Figure 7.2).
- For the receiver the SMS message is displayed in the Inbox so that there is no need to “open” the message (see Figure 7.2). However, if the user does so through habit, the short message text is displayed within a read-only form, with the message font set to blue to draw attention to the text (see Figure 7.5).

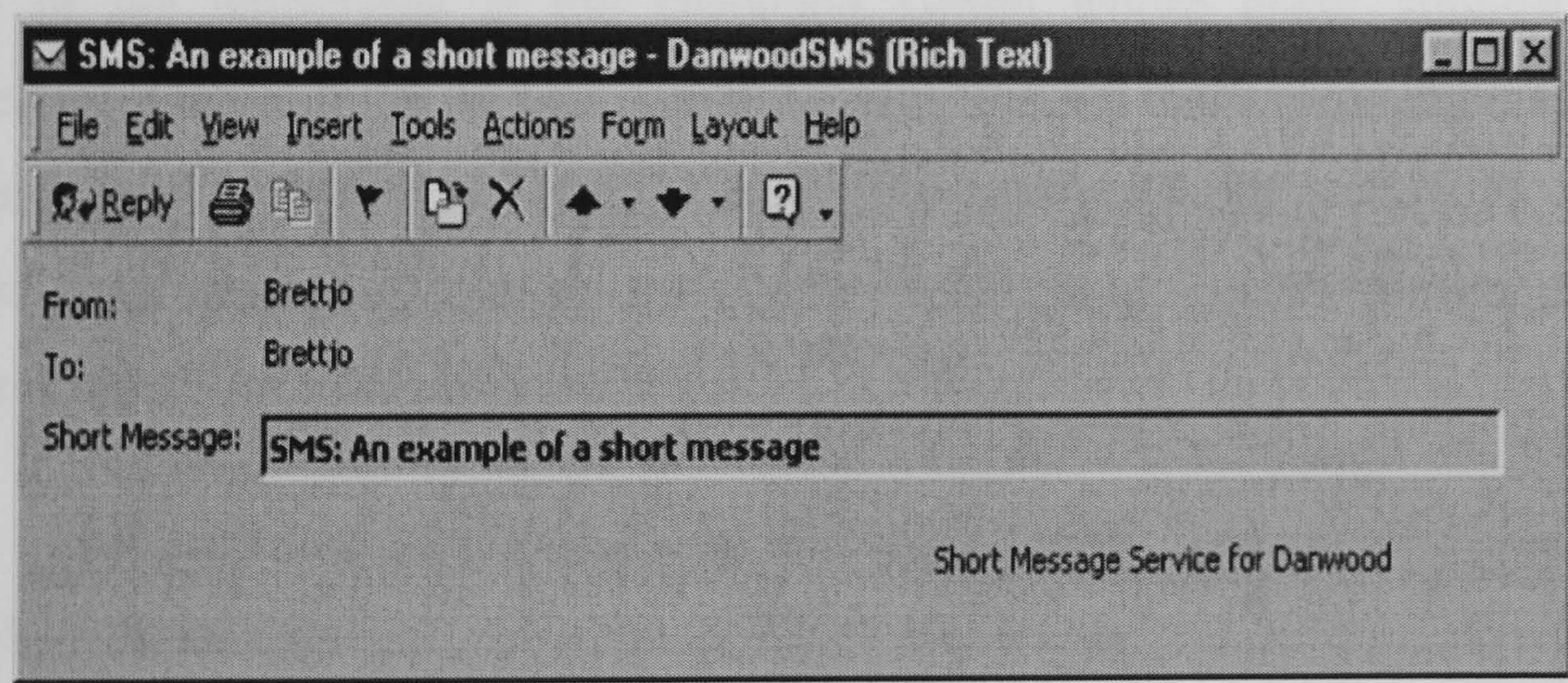


Figure 7.5 – The SMS read-only form

- The Reply to All, Forward, and Attach File functions have been removed to give users the sole option of replying to a short message as a short message and not as a traditional email.



## 7.6 Implementation of the SMS Email Tool

The implementation of the SMS email tool at the Danwood Group had some complications due to the current mail server not supporting Microsoft Outlook 2000 forms. To overcome this problem of not being able to send the new SMS email forms, the Windows Post Office was introduced. Through introducing the Windows Post Office an email address problem occurred, which was solved by introducing a new address format so that the intended email would be sent to the appropriate mail server. When a user wishes to send an SMS message, the user will use the *SMSFirstname.Surname* address format. The SMS Mail Traffic routes across the LAN where SMS are sent using the MAPI (Mail Application Program Interface) protocol. When a user wishes to send a traditional email the standard form is displayed and the sender will use *firstname.surname@company.co.uk* address format. Further details of how the SMS email tool was created are detailed in Chapter 5.

Twelve of the employees at the Danwood Group whose email application was upgraded received training on how to use the new Outlook 2000 application and, at the same time, how to use email SMS. A user guide was produced on how to use email SMS and was distributed to every employee whose email application was upgraded. The user guide is included as Appendix 4.

## 7.7 SMS Analysis

After the users had become familiar with the SMS system, a questionnaire was distributed to gain their feedback. The questionnaire is included as Appendix 1. Also the SMS messages sent by the users were recorded for analysis. The date, the one-line subject, sender and time were recorded for each SMS message sent. This allowed comparison between the recorded SMS message data and the questionnaire results.

The feedback from the users was good, with all of them saying they found the SMS add-on useful. A majority (80%) of users claimed the SMS add-on was quicker to use



than the traditional email system, with 40% of the users saying that the simple message box that is used to display and create a message saved them time. Figure 7.6 shows how the users rated themselves on their type of usage of the SMS application. The proportion of business usage, as found from the questionnaire, was higher than that recorded for traditional email (Jackson T.W., Dawson R. and Wilson D. 2000a). This higher figure could be explained by the self-evaluation, whereas in the author's earlier study the findings were based on actual monitoring of the email system as described in Chapter 6 (Jackson T.W., Dawson R. and Wilson D. 2000a).

Surprisingly, 80% of the users also said that they still preferred to use the traditional email messaging system to send messages. Only 20% of the users said that the supposedly eye-catching SMS icon was useful; that could account for the lower usage than expected, due to the users not seeing the icon to activate the SMS message text box shown in Figure 7.3.

When the employees were verbally questioned about the SMS application the majority thought the system saved them time writing emails, but more of their time was spent on deciding what the content of the one-line message should be, due to the restricted space. The employees also commented on how quick it was to be able to directly read the one-line SMS email from their inbox without having to open the email message to see the content. The general consensus was that the one-line email was more structured than a traditional email, which made replying easier.



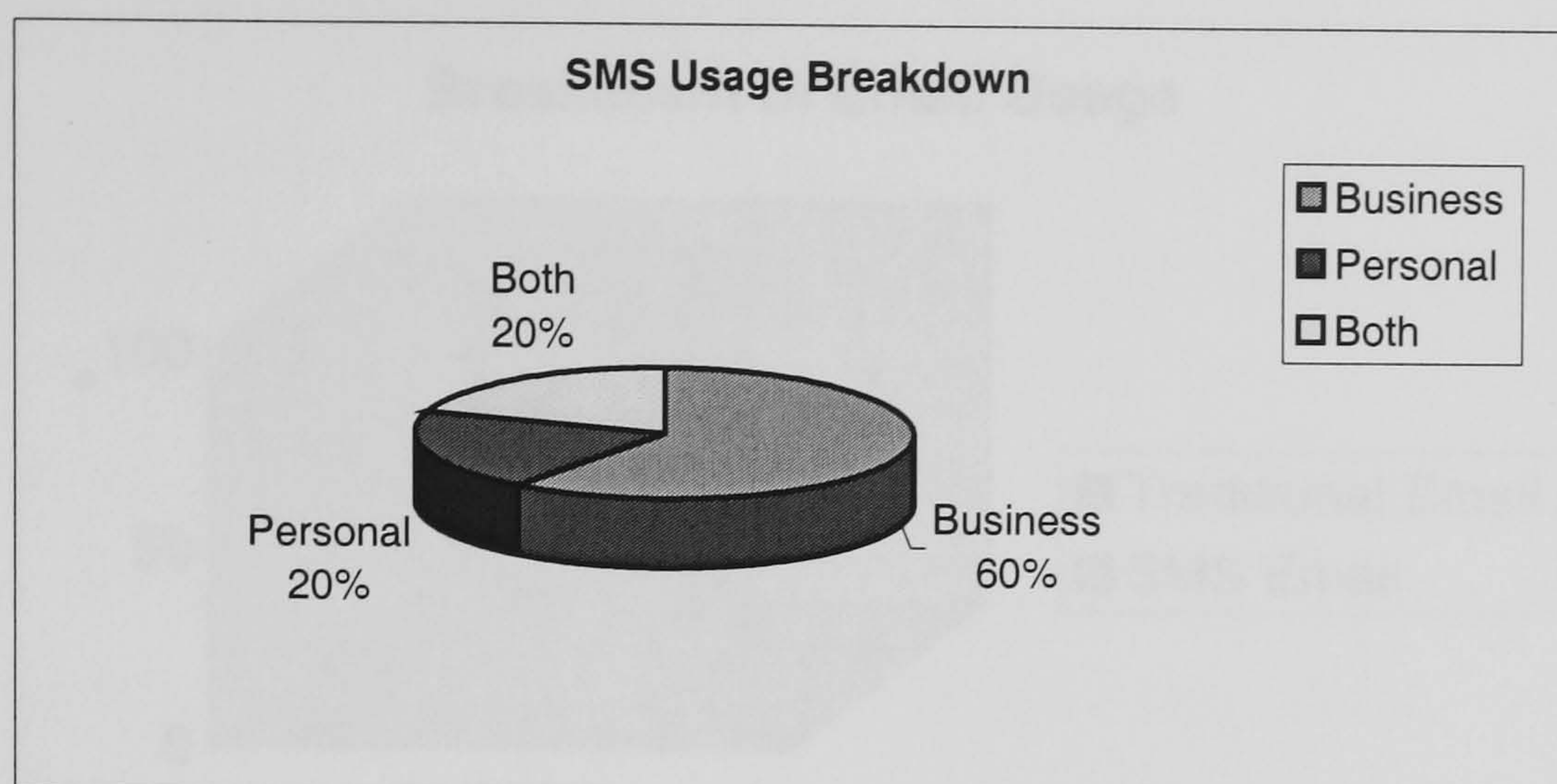


Figure 7.6 – SMS Usage - Percentage of Messages Dealt with per Employee (data from questionnaire)

The SMS message application was also monitored from the server to try and get a more accurate view of the usage. Monitoring was extremely difficult due to the specific way the SMS application had been implemented at the Danwood Group. All the SMS messages were stored and encrypted on the Microsoft Post Office server until the user downloaded them to their local machine. To decrypt the SMS message on the server required software from Microsoft, which was not available to the public. Eventually the author was able to get a copy of the software from Microsoft, but in turn this led to another problem. The software from Microsoft would only talk directly to the Post Office server, which meant that the messages could not be saved and analysed at a later date. This led to the SMS messages being analysed on-line every hour, which meant unfortunately some messages escaped analysis due to the monitoring being too infrequent. It would have been difficult to monitor more frequently due to the amount of processing power required from the server, which would have reduced its performance and affected the employees' productivity.



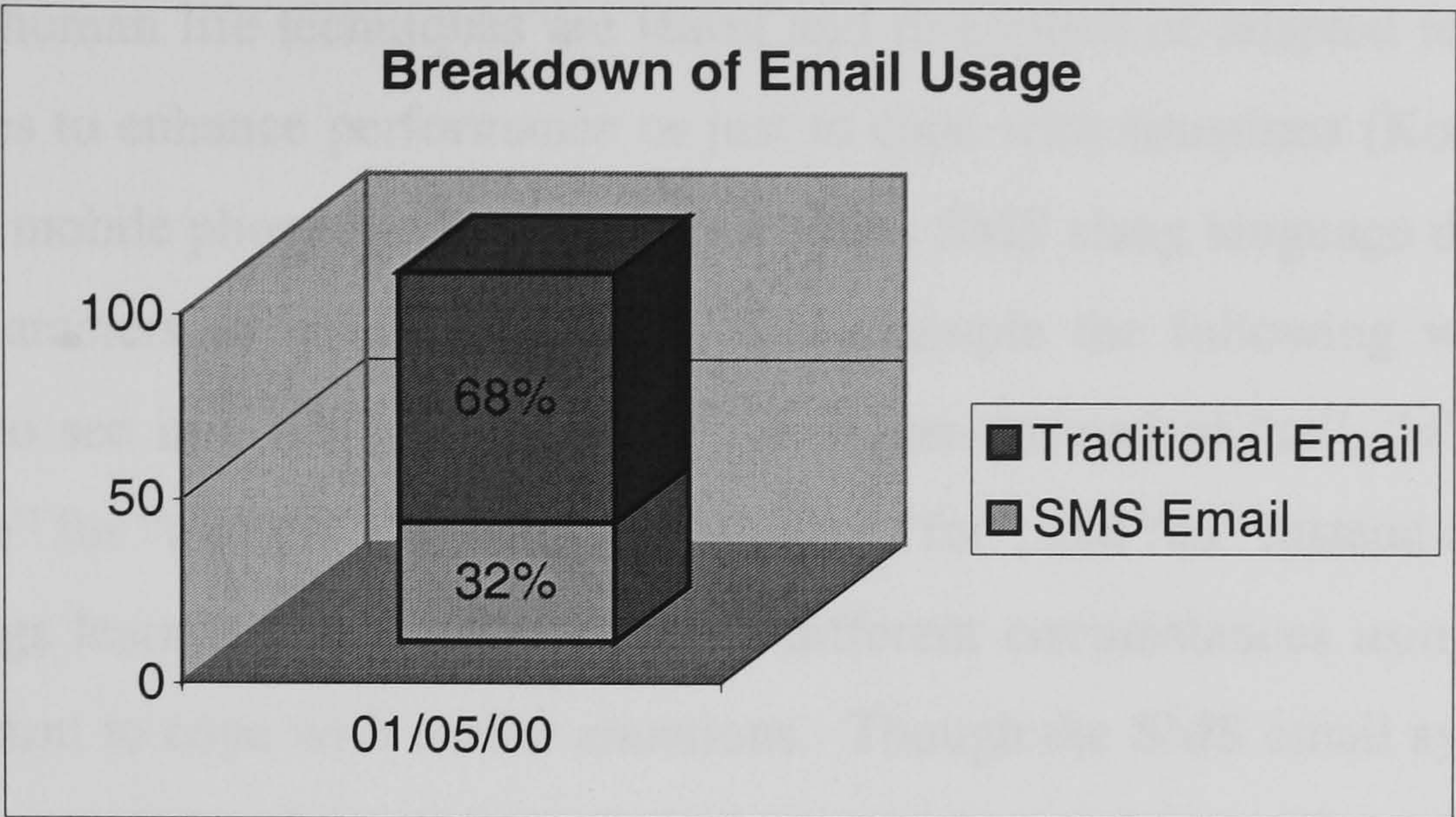


Figure 7.7 – Ratio of SMS Email Messages to Traditional Emails

The results gathered from the server have not shown a significant decrease in sending traditional email. Figure 7.7 shows the ratio between the numbers of SMS and traditional emails sent. With no significant decrease in traditional email usage, and with an employee sending on average three SMS emails a day, there may be one of two possible explanations for this. First, communication has been reduced in other areas such as the telephone, face-to-face, or even post-it-notes; or second, there has been no decrease in any communication medium but an overall increase in communication within the organisation. If SMS email means that there has been more communication taking place, this can only increase the coordination of company personnel and the processes they are involved in.

7.8 Evolution Learning

The reason for comparing the mobile phone and computer SMS systems is that their similarity may enable lessons to be learnt from the more established mobile system that can be applied to the less established SMS-via-email system. SMS on both systems has similar functionality, but the facility on both the mobile phone and the SMS email systems are subsets of the real function — the mobile is for voice communication and email is for full traditional text messages.



Throughout human life techniques are learnt and re-applied or adapted to in different circumstances to enhance performance or just to cope with situations (Kock N. 2000). SMS via the mobile phone has brought about a new SMS slang language due to having only 160 characters to write a message. For example the following would not be uncommon to see in a SMS message: “2” is written instead of “to”, “+” is used for “and”, “2nite” for “tonight”, “4” is used instead of “for”, and “cu” instead of “see you”. Human beings learn to adapt to all kinds of different circumstances using techniques they have learnt to cope with earlier situations. Though the SMS email system is only a subset of the traditional email system, and may not be used as much as the traditional email system, the author believes influences will cross from SMS email into traditional email. The author predicts that while the SMS email system is being used the traditional email message will change its form. The messages may become more succinct and SMS slang may appear. This change in email composition could never be taught in a training room, read in a manual or introduced by a company policy, as orders given within companies sometimes cause rebellions from reluctant employees having to change their ways to adapt to the company. Training through guided evolution can produce the desired results, in this case “to the point” and better-structured emails, saving employee time without the employees realising, like compensatory adaptation.

## 7.9 Conclusion

The advantage of email is that the electronic medium lends itself to the measurement and monitoring of the communication process. This means that, through usage policies and education, companies can act to try and reduce wasted time and improve employee effectiveness by experimenting with communication.

The results showed that on average an employee sent three SMS emails a day and there was no significant decrease in traditional email usage. The effect of the extra SMS communication on the other communication media is unknown. However, in the worst-



case scenario, if there has been no decrease in any of the other communication media but an overall increase in communication within the organisation, this can only increase the coordination of company personnel and the processes in which they are involved. However, this does imply that employees are subject to more interruptions per day, which can have a negative effect and is explained in Chapter 8.

The general consensus from the employees was that the one-line email was more structured than a traditional email, which made replying easier. For replying to be easier the received message had to be better structured and concise. It can be concluded that, as an educational tool, the SMS email application helped develop the employees' skills in forming better structured emails, and it has also increased the understanding of the use of IT within the organisation. The initial results are encouraging and, by improving the way the Danwood Group communicate, they should in turn improve company effectiveness, as communication plays a key role in many organisational processes. More research is required to confirm the findings and more data needs to be obtained, especially after the users become more familiar with using email SMS. It is also concluded that the results so far suggest that the introduction of a short-message email service has been of benefit to the Danwood Group and that other companies would similarly benefit if email service providers incorporated a short message facility into their software. As a direct result of this research, the Computer Science department at Loughborough University have adopted the convention of putting a ">" at the start of the email subject line to indicate that there is no email body. Though it is not greatly used within the department, it is a zero-cost option.



## CHAPTER 8 – THE COST OF INTERRUPT RECOVERY TIME

### Chapter Preface

This chapter is based on the “The Cost of Email Interruption” paper, which was published in the special edition of the JoSIT journal and “The Ethics of Electronic Monitoring within the Workplace” paper, which was presented at the Software Quality Management conference in April 2001 (Jackson T.W., Dawson R. and Wilson D. 2001), (Jackson T.W. et al. 2001). The use of email by employees at the Danwood Group was studied and it was found that the interrupt effect from emails was non-trivial. The common reaction to the arrival of an email is to react almost as quickly as responding to telephone calls. This means the interrupt effect is comparable with that of a telephone call. The recovery time from an email interruption was found to be significantly less than the published recovery time for telephone calls. It is to be concluded, therefore, that while email is still less disruptive than the telephone, the way the majority of users handle their incoming email has been shown to give far more interruption than expected.

By analysing the data captured the author has been able to create a set of recommended guidelines for email usage within the workplace that will increase employee efficiency by reducing the prominence of interruptions, restricting the use of email-to-all messages, setting up the email application to display three lines of the email and to check for email less frequently. It is recommended that training should be given to staff on how to use email more effectively to increase employee effectiveness.

### Chapter Keywords

Interrupt, Recovery Time



## 8.1 Introduction

Email is becoming an integral part of the communication structure within organisations and is frequently the basis of collaborative communication between researchers and developers on projects undertaken at multiple locations. Indeed, even when the whole project is undertaken on a single site, email is often regarded as essential to ensure communication and coordination between team members. However, the costs and benefits are not being assessed to show when it is a more effective communication process than traditional methods. Communication is carried out in many different forms, but the common underlying motive of communication is to improve working practices and to increase employee effectiveness.

This chapter resulted from a study of the communication methods within the Danwood Group. The investigation of the benefits of email relative to traditional communication methods forms a study within the company to establish the value of such analysis. The use of IT for communication was chosen for the initial study as the organisation has rising communication overheads, with the consequent reduction of employee effectiveness within all functions. The company expects that a basic understanding gained from this study will provide the data for communication planning in terms of enabling employees to become more effective through suggesting ways they can improve their email interaction skills.

To date there has been little research carried out into email usage and the effect of email on the workplace. The author believes there are a number of reasons for this, such as the ethics related to monitoring employees at work, or the difficulty of interpreting the data captured. In earlier stages of the research, described in Chapter 6, it was found that, in an established email system, 43% of emails dealt with were non-business-related, which equated to just under two weeks per year (Jackson T.W., Dawson R. and Wilson D. 2000a). This could either be seen as undesirable for a company because of lost revenue, or an excellent way to aid team building.



The author’s research findings in this chapter show that there is an interrupt recovery time for email and that the majority of email users answer email just as quickly as the telephone. The chapter also highlights natural communication patterns during the day that could be used to enhance employee effectiveness by reducing the number of interrupts an employee receives.

## 8.2 The Method

There were numerous ways the interrupt recovery time metrics could have been recorded and these have been discussed in Chapter 5. As mentioned in Chapter 5 it was decided that the WinVNC application would be used to monitor employee activity. WinVNC, as shown in Figure 8.1, is a remote display system that allows viewing of a remote computer “desktop” environment, not only on the machine where it is running but also from anywhere on the Internet and from a wide variety of machine architectures (Cambridge 2000). To record the employees’ activities for eight hours a day required a large storage medium. The server-side machine had an ATI 128 All-In-Wonder graphics video card installed, so that a video recorder could be attached to record employee activities during the day. Four-hour videotapes were used in long-play recording mode to give a full eight hours of recording.

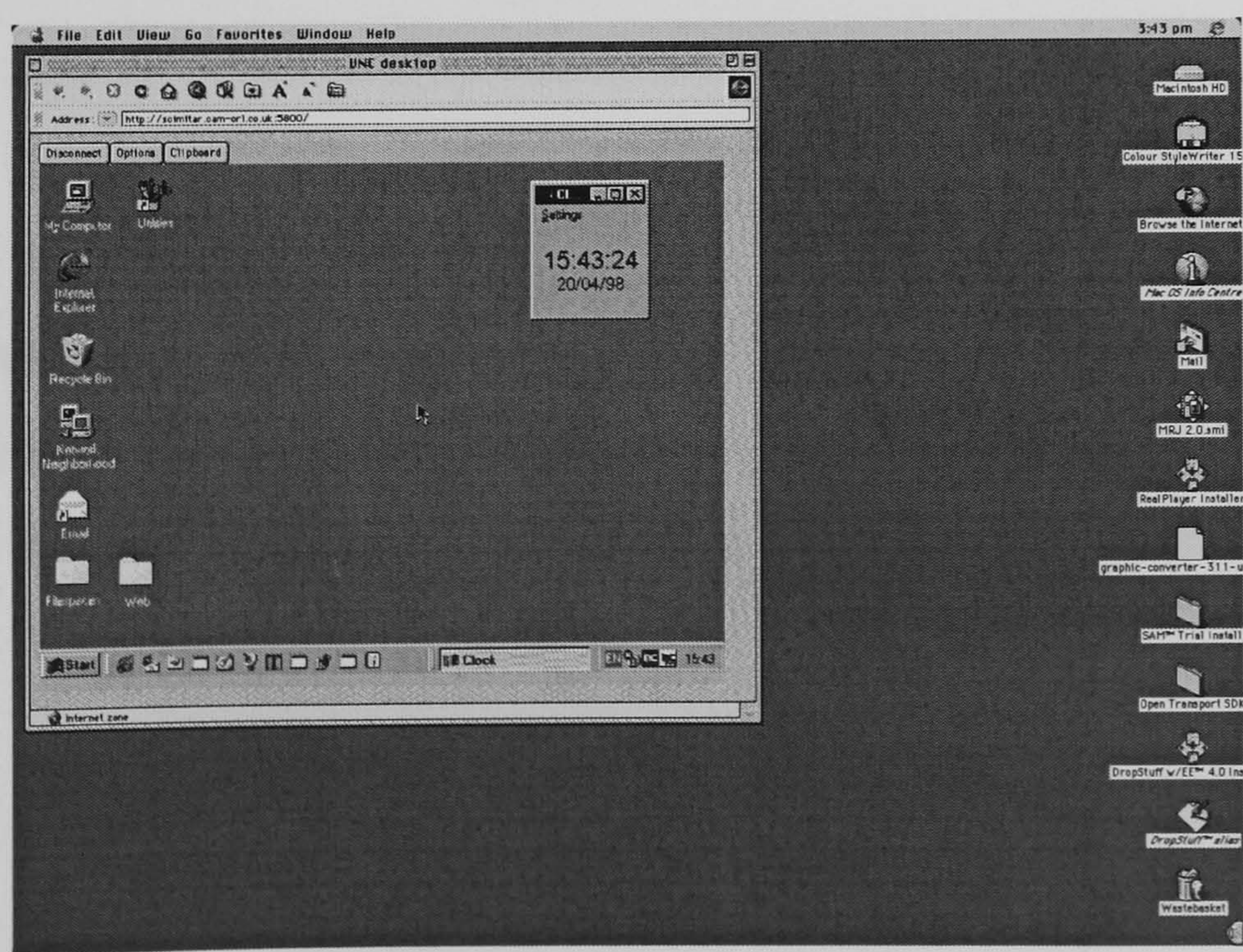


Figure 8.1 – A Windows desktop being accessed from a Macintosh using WinVNC.



A total of 16 employees were monitored over 28 working days, which led to over 180 hours of videotape recordings. Various types of employees were monitored, such as clerks, programmers and managers. The author selected the subjects according to their job title, age and their previous history of using email. If a subject rarely used email, for example once a week, the subject would require vast monitoring to try and capture any kind of interaction with the email system and thus it would have not been practical due to time constraints. Also the subject wouldn't reflect the majority of email users at the Danwood Group who use the email system on a daily basis.

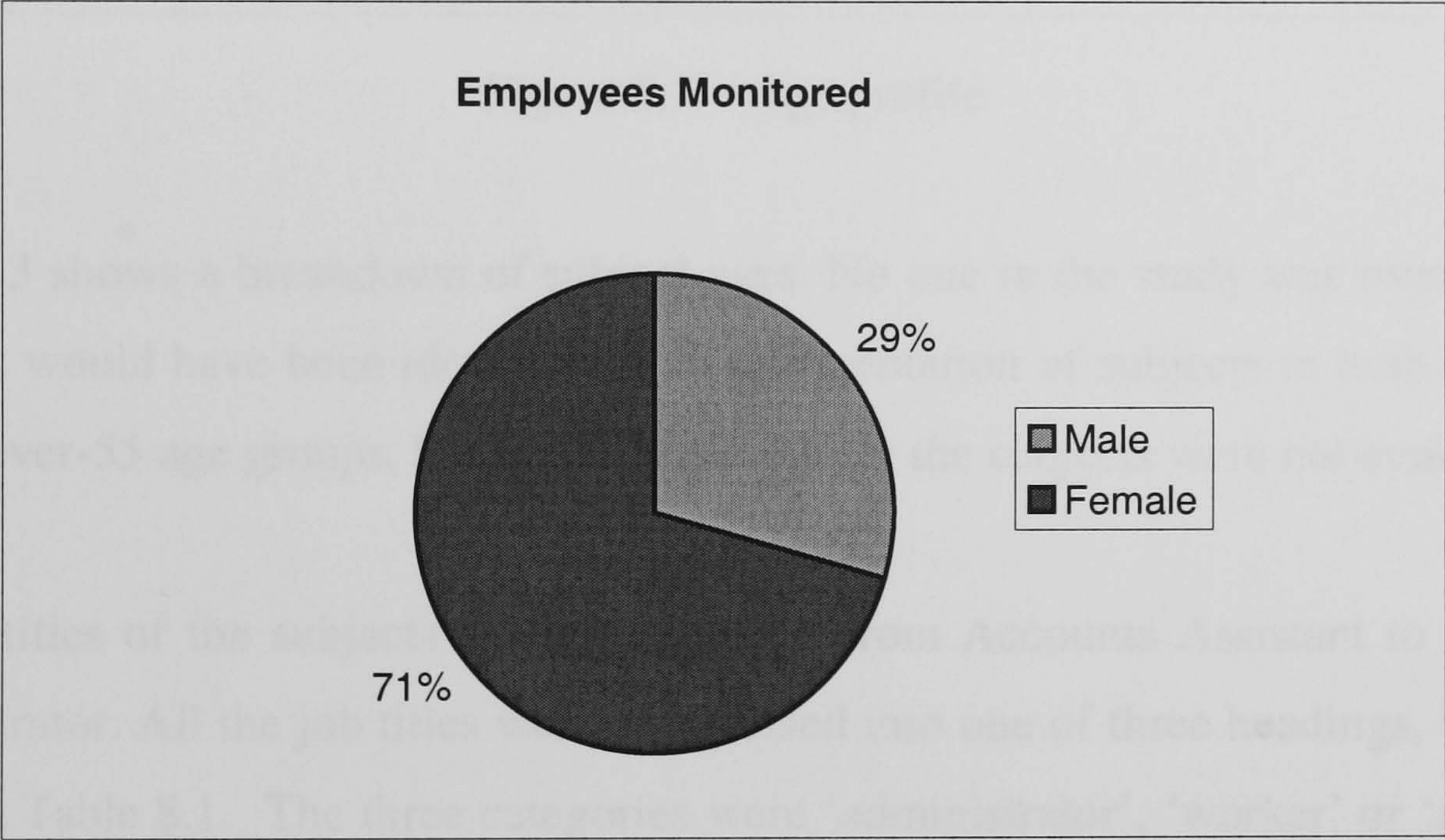


Figure 8.2 – Gender profile

Figure 8.2 shows the gender breakdown, which indicates only 29% of the participants were male. Ideally this should have been higher to give a more even split but unfortunately it was not possible due to the constrained availability of subjects.



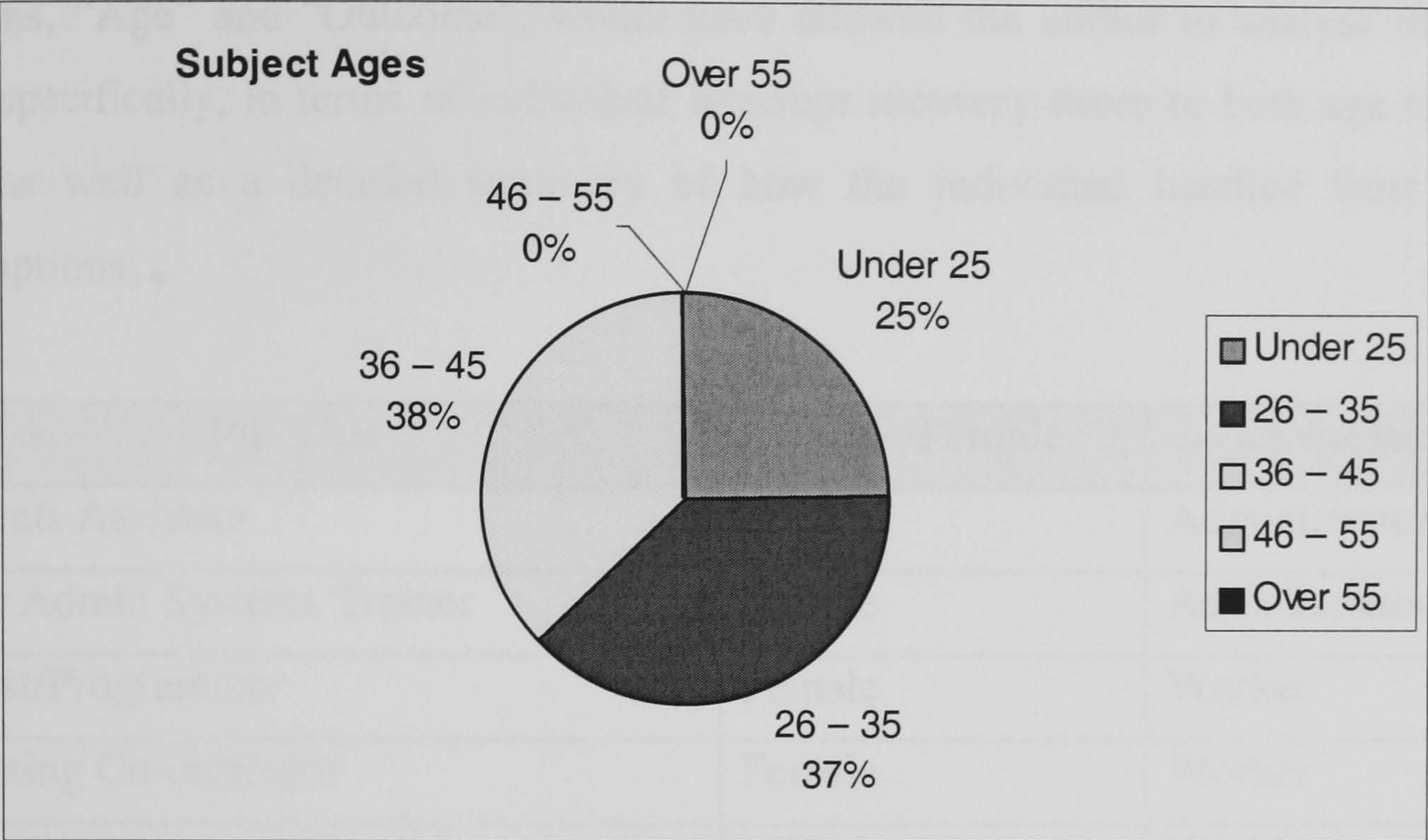


Figure 8.3 – Age profile

Figure 8.3 shows a breakdown of subject ages. No one in the study was over 46 years of age. It would have been ideal to have a representation of subjects in both the 46-55 and the over-55 age groups, but again unfortunately the subjects were not available.

The job titles of the subjects monitored varied from Accounts Assistant to Contracts Administrator. All the job titles were categorised into one of three headings, which are shown in Table 8.1. The three categories were ‘administrator’, ‘worker’ or ‘manager’. An ‘administrator’ was classed as either a secretary or an assistant whose job was to aid the workers. A ‘worker’ was classed as an employee who directly contributed to the company, rather than contributing to an employee within the company. A ‘manager’ was classed as an employee who had employees working for him or her. The categorisation was not purely based on job title, but determined by getting to know the subject and their role within the company.

The author sought permission from the Danwood Group to add two extra columns to Table 8.1, but unfortunately the request was denied, due to being too employee-specific and the possibility that the information might reveal individual identities. The two extra



columns, “Age” and “Outcome”, would have allowed the author to analyse the data more specifically, in terms of individual interrupt recovery times to both age and job title, as well as a detailed summary of how the individual handled their email interruptions.

Job Title	Male/Female	Categorisation
Accounts Assistant	Female	Administrator
Group Admin Systems Trainer	Female	Administrator
Analyst/Programmer	Female	Worker
Marketing Co-ordinator	Female	Worker
Buyer	Male	Worker
Rental Administrator	Female	Administrator
Regional Branch Administrator	Female	Administrator
Senior Programmer	Male	Worker
Purchasing Manager	Male	Manager
Administrator	Female	Administrator
Analyst/Programmer	Male	Worker
Marketing Assistant	Female	Administrator
Purchasing and Contracts Supervisor	Female	Worker
Fleet Co-ordinator	Male	Worker
P.A to H&S Manager	Female	Administrator
Contracts Administrator	Female	Administrator

Table 8.1 – Breakdown of Employees Monitored and their Job Types

Figure 8.4 shows the percentage breakdown of the types of employees monitored. The three categories have been used to determine which are best suited to dealing with interruptions. Though the number of subjects were limited and only one manager took part, the calculation was still made for reference for future work in other organisations.



Though quite subjective, the calculation was also made between who can handle interruptions more efficiently, male or female. The results of both calculations should not be interpreted in too much depth as more subjects are required for an accurate finding and a more accurate job categorisation system is required.

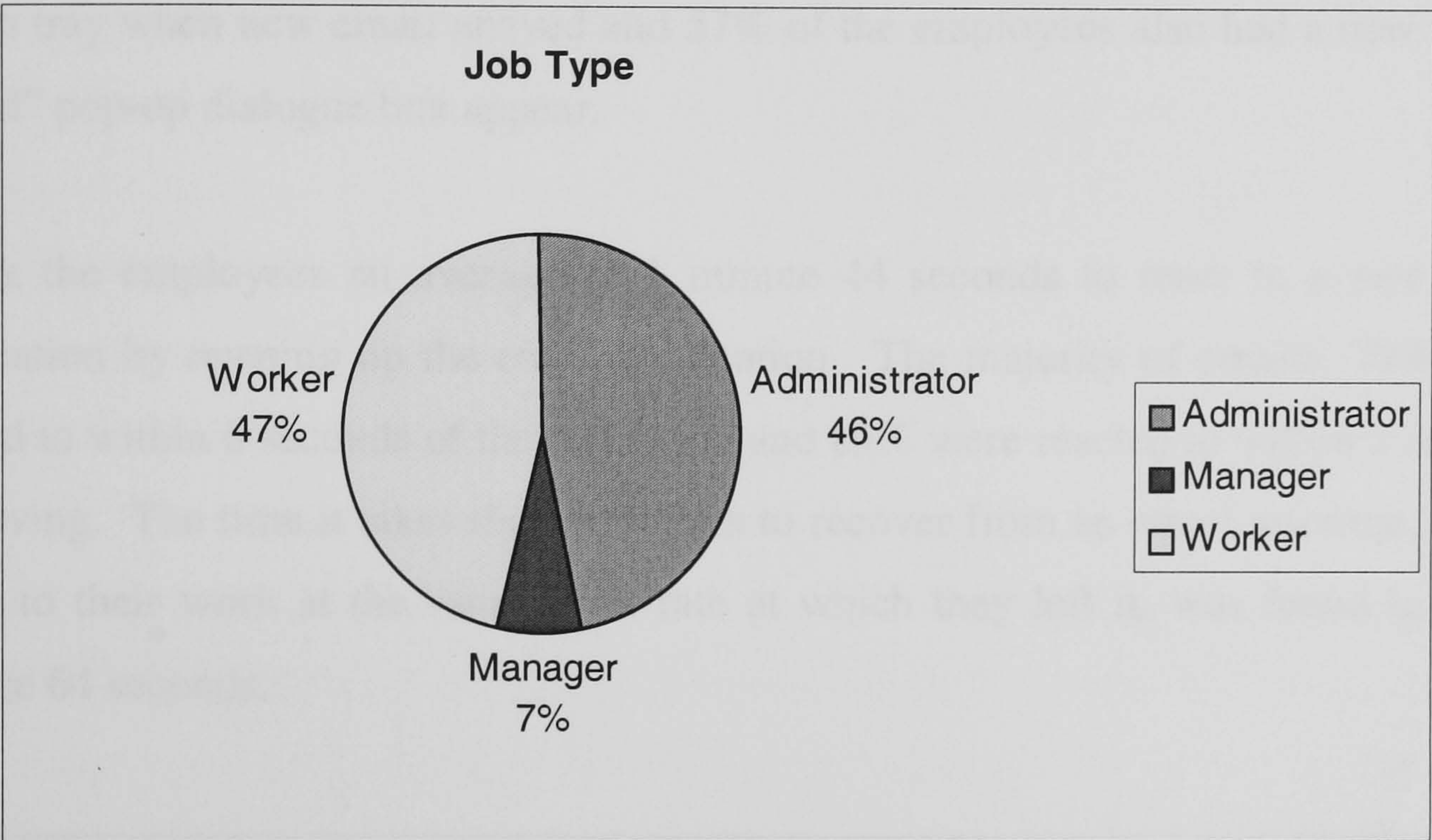


Figure 8.4 – Percentage Breakdown of Categorisation of Job Titles

8.3 Email Interrupt Recovery Time

All the employees’ email interactivity was recorded and analysed as well as the activities leading up to and after the email interruption. The definition of an email interrupt is “any email distraction that makes employees stop their planned activity”. The recovery time was calculated by recording the amount of time that it took employees to return to their work at the same work rate at which they left it. This required an element of judgement by the person reviewing the recorded material. However, in nearly every case there was a clear point where the user ceased to move the mouse around the screen and jump between screens trying to pick up their train of thought and the production of useful work. Although this may be regarded as a rather inexact measure, the clear change as the user starts productive work means that, in



practice, interpretation of the activities by different people would not have given any significant difference in the results.

Out of the employees monitored 70% used Microsoft Outlook 2000 and 30% used Microsoft Outlook 97. All the employees had a new “email arrived” icon appear in the system tray when new email arrived and 57% of the employees also had a new “email arrived” pop-up dialogue box appear.

It took the employees an average of 1 minute 44 seconds to react to a new email notification by opening up the email application. The majority of emails, 70%, were reacted to within 6 seconds of them arriving and 85% were reacted to within 2 minutes of arriving. The time it takes the employees to recover from an email interrupt, and to return to their work at the same work rate at which they left it, was found to be on average 64 seconds.

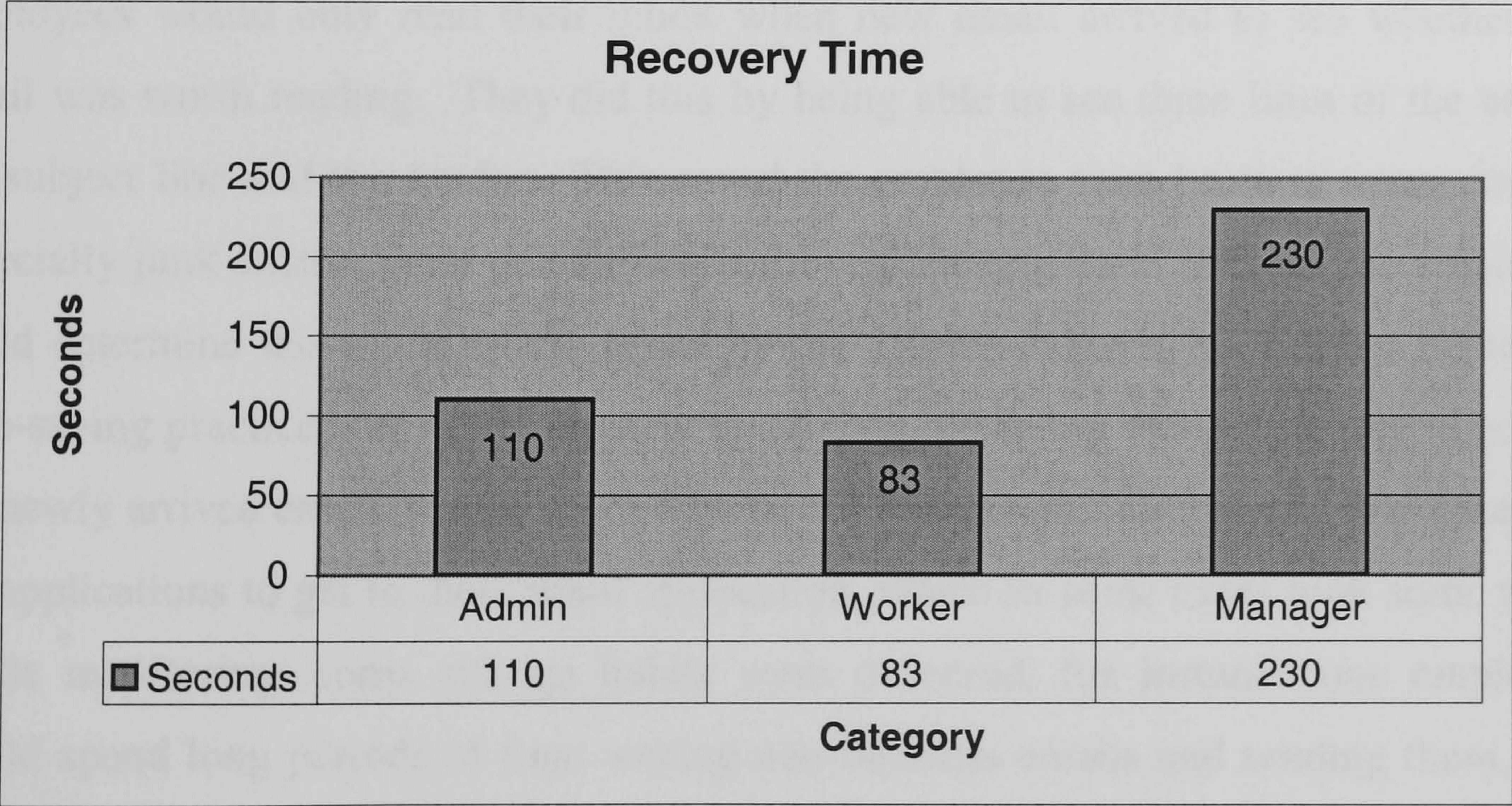


Figure 8.5 – A Breakdown of Interrupt Recovery Times per Category in Seconds

Figure 8.5 shows different interrupt recovery times for the various different groupings of the subjects. Though only a few subjects qualified for certain categories the results



show some interesting findings. The “worker” category has the quickest interrupt recovery time, at an average of 83 seconds, followed by the “administrator” category, which took 110 seconds. As only one subject was in the “manager” category the results are unrepresentative and cannot be compared against the “administrator” and the “worker” categories. If the number of subjects in the study were significantly higher, the male and female groupings could have been broken down as sub-categories of “Administrator”, “Worker” and “Manager”. This could have given, though crudely, an insight into which gender is likely to handle interrupts more efficiently in the different kinds of jobs. However, the study showed that there is only a slight difference between the interrupt recovery times for females and males. The females are 14 seconds quicker at getting back into their work.

Through analysing individual employees a number of good email practices emerged; and combining these practices and getting employees to adopt them could increase employee effectiveness and aid in better interrupt handling. For example, a number of employees would only read their inbox when new email arrived to see whether the email was worth reading. They did this by being able to see three lines of the email, the subject line and the sender. This saved the employee time because many emails, especially junk emails, were deleted without even opening them because the employee could determine the nature of the email by the 3 lines of email on display. Another time-saving practice was to use the new email icon located in the system tray to access the newly arrived email. It may seem simple, but a number of employees minimised all the applications to get to their email application, which in some cases took some time. While monitoring, some strange habits were observed, for instance one employee would spend long periods of time writing non-business emails and sending them, and would then later that day spend even longer re-reading what had been sent.



## 8.4 Interruption Patterns

There have been various observations about email and whether it has an interrupt recovery time associated with it, as the receiver of an email is perceived to deal with it at their own convenience (DeMarco T. and Lister T. 1999), (Zijlstra Fred R.H. 1999), (Solingen R., Berghout E. and Latum F. September/October 1998). This study has shown that 70% of emails dealt with were viewed within 6 seconds, which is quicker than letting the phone ring three times. Only a very small minority of employees would let the new email go unattended until they had come to a point where it was convenient to stop work and attend to the email. It is difficult to tell whether the initial distraction of a new email arriving, either by sound, “new email” icon in the system tray or the email pop-up dialogue box appearing, does affect the employee, because it is difficult to tell what someone is thinking. After the employee has been told about the new email and chooses not to respond, might they be thinking, “I wonder who has sent me an email”? It is like being sent an interesting parcel through the post and having to resist the temptation not to open it until the current job has been finished. However, electronic monitoring could not have captured this kind of information, although surveying the employees might have given an insight into their thoughts.

DeMarco and Lister have described the high impact of phone calls in engineering environments: developers routinely receive 15 telephone calls a day, which can make the whole day non-productive (DeMarco T. and Lister T. 1999). In Solingen’s research, educating employees about the negative effects of interrupts has decreased interruptions by 30 percent (Solingen R., Berghout E. and Latum F. September/October 1998). Speculatively, if employee education on interrupt awareness was effective, a company could double the amount of useful emails without increasing the level of non-business. If this could reduce telephone calls by 4 per employee per day it would in turn save 60 minutes’ recovery time as well as the time taken for the actual telephone calls. The findings of the email analysis show that, on average, 90 seconds is spent per email excluding recovery time. If the recovery time is anything less than 13.5 minutes per email, compared to a voice call on the telephone and the assumed 15-minute



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interrupt recovery time, then there is clearly a gain in the overall time taken in the communication. Indeed, if the recovery time was reduced to 3 minutes per email, the overall time saved by moving 4 calls to email will be greater than 40 minutes for each employee every day. The research into telephone interrupt recovery times was carried out on software developers, and the 15 minutes it takes a software developer to recovery from a telephone interruption is unlikely to apply to most of the employees studied at the Danwood Group. However, the 15-minute interrupt recovery time gives an indication of the time that could be saved if an employee decided to use email instead of the phone for some of their communication.

It appears that the pattern of communication for email is quite different to that of other forms of communication. Figure 8.6 shows the interaction time on the email system throughout the day. The graph measures email interactivity, where email interactivity is classed as a user reading or composing a message including reply, reply to all and forwarding. There are two main peaks, one at 8:30am, which is due to employees coming into work and checking for new email, and one at 16:30pm, which is due to the employees checking their email before they go home. This uneven distribution of communication will concentrate the interrupts at certain times of the day, which is likely to reduce the overall disruptive effect. Email users seem to use the communication tool at different times and for different purposes, both when sending and receiving. However, there is a lack of data on the traditional communication media to quantify the differences.

While carrying out the interrupt recovery research using WinVNC, the number of email file collections per day per employee was also recorded. From the earliest research to the very latest findings, both sets of results complemented each other even though there has been a year between the two recordings. The graph shown in Figure 8.7 shows the average number of email file collections per day per employee. The figures are distorted due to the number of employees infrequently using the email system. Out of 267 employees downloading email files from the server only 40% of



them were frequent email users. The application did not record the attempts made to check whether emails were on the server for that individual employee, but recorded successful email downloads. Even so, on average there were 2 successful email file downloads per day, which could contain one or more emails. Microsoft Outlook 2000 has a facility, as many other email clients do, that allows the user to set the frequency of when the email application should check for new mail. The results at the Danwood Group highlighted the fact that the majority of employees have their email application set to check for email every 5 minutes.

The two graphs (Figures 8.6 and 8.7) suggest that there are four natural communication periods during the day, as the smaller peaks in Figure 8.6 at 11:30am and at 14:30 complement the peaks in Figure 8.7. Communication patterns require further research to try and establish how to increase employee effectiveness by finding the best time to communicate during the day to keep interrupts to a minimum. However, companies could experiment and encourage the majority of communication to take part during these natural peaks to help reduce employee interrupts and to reduce the risk of message fatigue (Zijlstra Fred R.H. 1999).

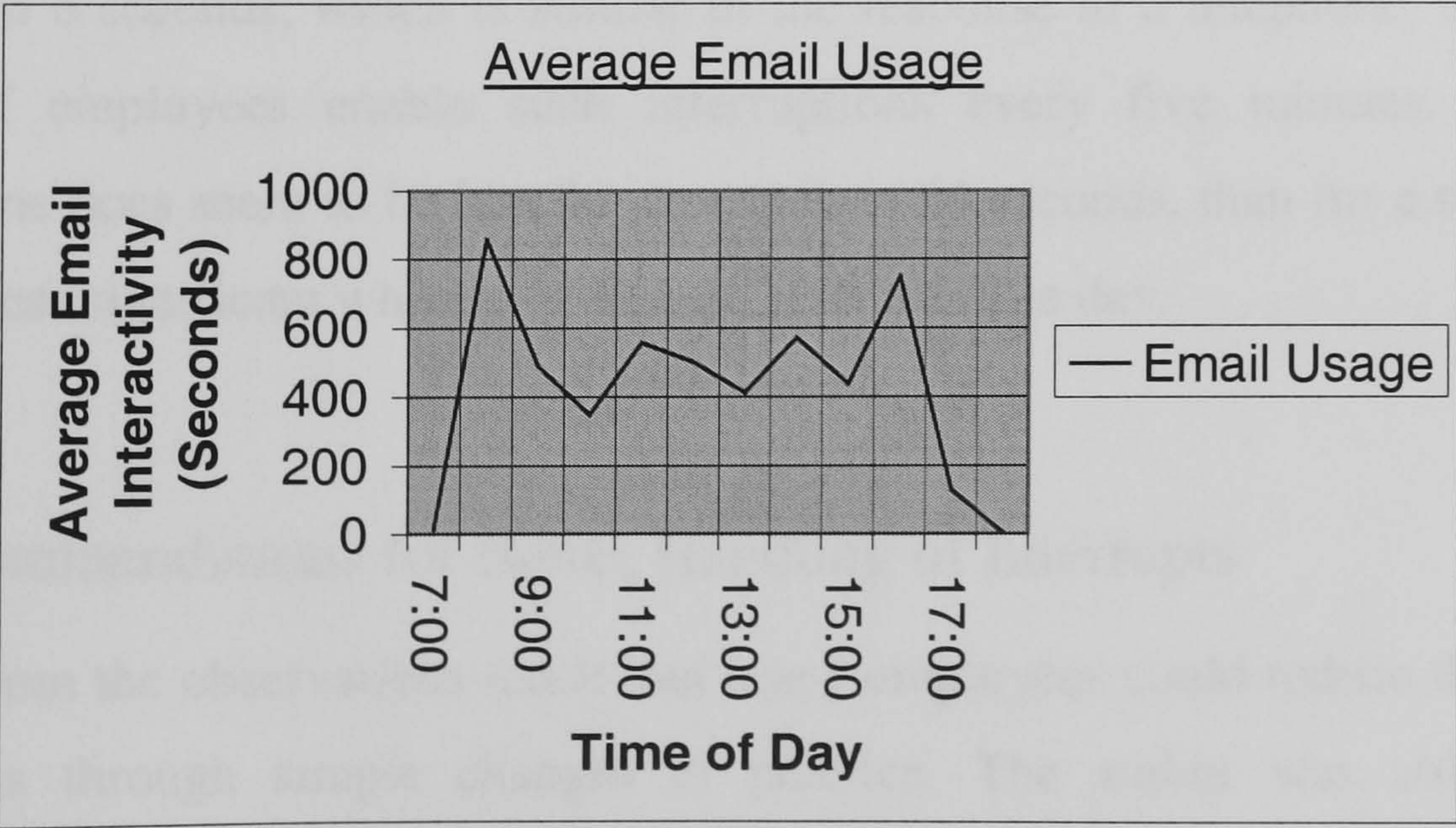


Figure 8.6 – Email usage throughout the day



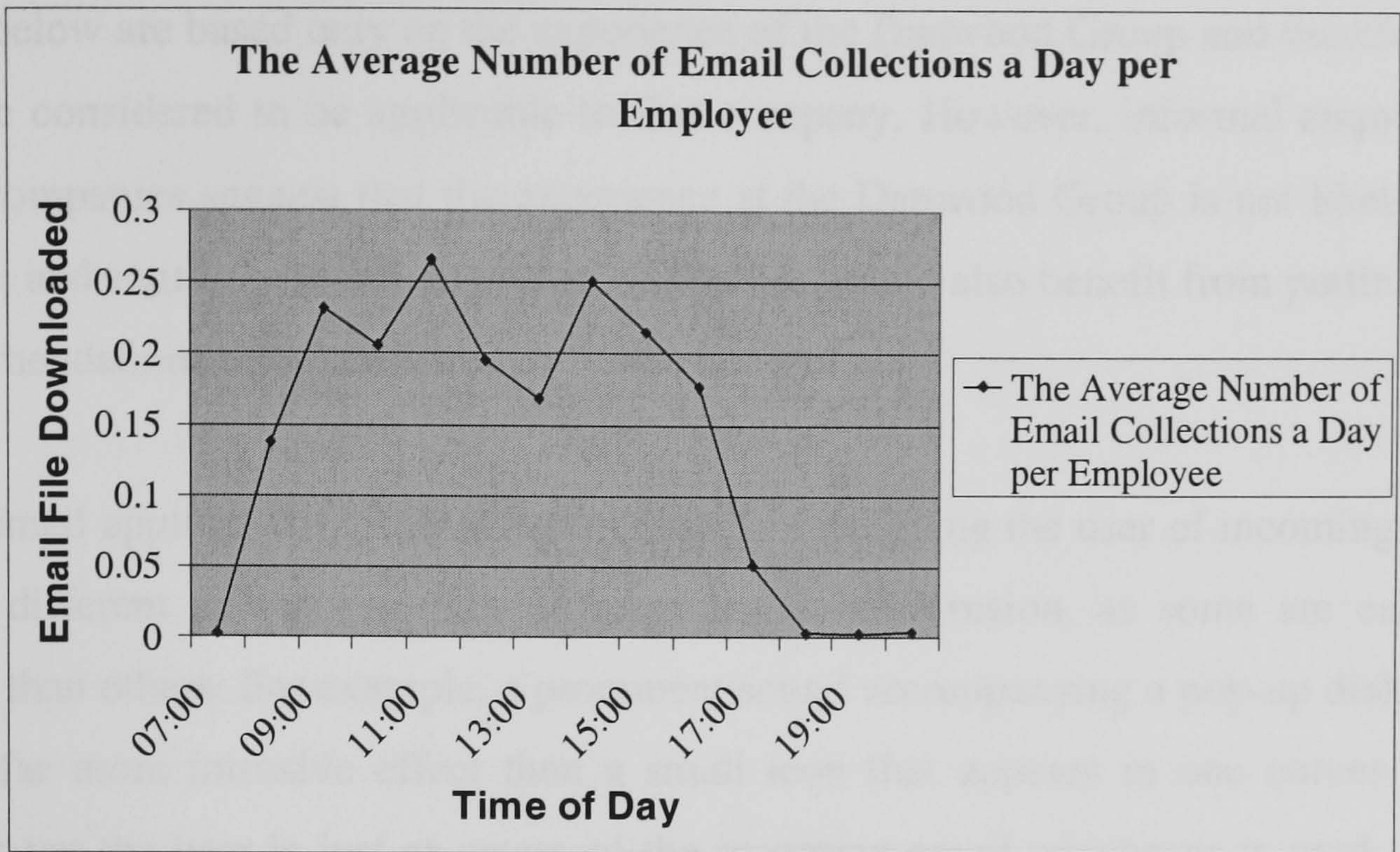


Figure 8.7 – The Average Number of Email File Collections per Day per Employee

This research has, however, shown that email messages do have some disruptive effect by interrupting the user, probably more than is generally assumed. It is commonly believed that, because users can read emails in their own time whenever it is convenient, interruptions are negligible (DeMarco T. and Lister T. 1999), (Zijlstra Fred R.H. 1999), (Solingen R., Berghout E. and Latum F. September/October 1998). In practice, however, this research has shown that the majority of employees respond to email within 6 seconds, which is similar to the response to a telephone, and that the majority of employees enable such interruptions every five minutes. While the recovery time does seem to be less for an email, at 64 seconds, than for a telephone, it is nevertheless significant when accumulated over a whole day.

8.5 Recommendations for Better Handling of Interrupts

It is clear from the observations made that many employees could reduce the time lost to interrupts through simple changes of practice. The author was able to make recommendations to the company that would allow more effective and efficient use of email, which in turn should make employees more productive. The recommendations



given below are based only on the experience of the Danwood Group and therefore can only be considered to be applicable to that company. However, informal enquiries of other companies suggest that the experience at the Danwood Group is not likely to be unique, and so it is believed that other companies would also benefit from putting these recommendations into practice.

Most email applications allow different means of notifying the user of incoming email. These different means can give different levels of intrusion, as some are easier to ignore than others. For example, a prominent sound accompanying a pop-up dialog box has a far more intrusive effect than a small icon that appears in one corner of the screen; yet the user is just as aware of the incoming email whichever is used. A less intrusive notification method may encourage users to respond in their own time, at a moment which is more convenient for them, and which will give less of an interruption to their concentration on the job in hand.

It was notable that many of the email messages that employees received were not really relevant to them. This usually resulted from an email sent to all employees. This was particularly true when employees used a reply-to-all message when the whole company received the message, yet it was often only useful to one or two individuals. To reduce this problem employees should be encouraged to restrict their use of email-to-all messages, and especially reply-to-all messages. This may be achieved through better education and training on the use of email. A further encouragement may be to provide more targeted user groups to allow employees to be more selective about whom they contact.

The employees who used the facility to display the first three lines of each message were able to make more effective use of their email monitoring activity. This should be a practice that all employees should be encouraged to adopt. If all employees used this facility it would reduce the effect of the widespread interruptions caused by email-to-all messages.



Although many employees set their email applications to check for email every five minutes, the nature of email means that it is unlikely to matter if an employee waits a little longer. It would be more productive to the user if the email was checked at an interval when interrupts would be less frequent and possibly even beneficial. Many people find that long periods of concentration on one single task reduces their effectiveness, and for that reason it can be beneficial to take a break and think about something else for a few minutes. The length of time a person can effectively concentrate on one task will vary from person to person, but typically a break after 45 minutes or so is likely to be beneficial. This gives an indication of how long an interval would be desirable for email interrupts. If employees set their email applications to check for email no more frequently than every 45 minutes (or whichever interval they find most suitable for themselves) then the interruption that does take place is clearly less disruptive and could even have a beneficial effect.

During the study it was noticeable that none of the employees monitored used message rules within their email application. If rules are applied to incoming email, the email can be delivered to a predetermined folder, which aids in the processing of email. For example, setting up message rules to send all alias group email to individual news group folders can help determine if the incoming email is urgent, because generally information gained from news groups does not require immediate attention. Some training on the use of message rules and separate folders could enable users to make better use of their email application to categorise and prioritise email, so that they can make more effective use of the time spent handling incoming messages.

## 8.6 Conclusion

This research has found that the interrupt effect from emails is more than might be believed. Employees at the company studied allowed themselves to be interrupted almost as frequently (every 5 minutes) as with telephone calls. The common reaction to the arrival of an email is not to delay the response to a time that is more convenient to



the user but to react within 6 seconds, again almost as quickly as they would respond to telephone calls. This means the interrupt effect is comparable with that of a telephone call. The recovery time from an email interruption is, at 64 seconds, significantly less than some published recovery times for telephone calls. While this gives a significant reduction in recovery time, with users receiving more and more emails the cumulative effect is still likely to be significant. It is to be concluded, therefore, that while email is still less disruptive than the telephone, the way the majority of users handle their incoming email has been shown to cause far more interruption than expected.

By analysing the data captured from the employees interacting with the email application and how they dealt with the frequency of interrupts, the author has been able to create a set of recommended guidelines for email usage within the workplace that will increase employee effectiveness.

- Reduce the prominence of interruptions through turning off the new email alert dialogue box and email sound alerts.
- Restrict the use of email-to-all messages, and in particular reply-to-all messages. The use of more targeted email user groups may assist in this respect.
- Set up the email application to display in the inbox the sender, the subject and three lines of the email, so that the recipient can quickly determine if the email requires immediate attention.
- Set up the email application to check for email at no less than every 45 minutes.
- Introduce training to all staff on how to use email in areas such as setting email priority, email housekeeping with message rules, effective use of user groups and address books, and constructing better structured emails.

By taking a “typical” employee and making some hypothetical assumptions it is possible to determine the amount of time that can be saved through implementing the guidelines mentioned above. If an employee has set up the email application to check



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for email every 5 minutes then it is possible, if (s)he is a heavy user of email, that there could be 96 interruptions in a normal 8-hour working day. However, if the email application was set up to check for email every 45 minutes then the amount of possible interruptions is reduced to 11 per day. For example, if it takes on average 1.5 minutes to read and recover from an email and the employee is interrupted every 5 minutes, then this would only leave the employee 3.5 minutes before the next interrupt. However, if the employee was interrupted every 45 minutes and the emails had accumulated to a total of 9, then it would take on average 6 minutes to read all 9 emails and recover from the interruption. This would then leave 39 minutes before the next interruption, allowing the employee more time to get on with “real” work.

Disruption can also be minimised by reducing prominent “new email” alerts. Through turning off “new email” pop-up dialogue boxes and sound alerts, and by just having a “new email” icon appear in the system tray, a user will be less aware that an email has arrived. This is useful as, if the employee is in the midst of concentration, a prominent interruption will break their thought processes. By only having the new email icon in the system tray, employees’ attention would only be attracted when their concentration levels are not so high and the interrupt would occur at a more convenient time.

It would be beneficial to the majority of employees to restrict the use of the email function “reply-to-all”. Chapter 6 shows that not many employees use it, and in the author’s experience the function is normally used by accident. For example, if the reply-to-all function is used on an email containing 120 recipients it could collectively cost the company 3 hours of employee time in being interrupted and viewing the email.

Throughout the study some employees had developed their own ways of dealing with new emails. A number of employees had set up their email application to display three lines of the email subject, the sender and date within their inbox. This was thought to save them time, as they would quickly scan the new email in the inbox and determine if



it was important. If it was important they opened the email, or otherwise they left it to a more convenient time to read it.

This research has shown the value of measuring communication processes. The analysis of email has enabled the effect on employee time to be quantified and has given some surprising results. This has led to a series of recommendations that will enable the Danwood Group to make better use of email communication and increase employee effectiveness. The implication for managers in other companies is that if their own employees have similar practices in using email then the companies would also benefit from following these recommendations.



## CHAPTER 9 – Summary, Conclusions and Recommendations for Further Work

### Chapter Preface

This chapter summarises the whole thesis, relating the work to the aims, objectives and hypothesis set out in Chapter 1. Conclusions and recommendations for further work are included to provide direction for future research work by the Danwood Group and / or other interested persons.

### Chapter Keywords

Summary, Conclusions, Email Effectiveness

### 9.1 Summary

The general hypothesis of the research has been to examine the “hard cost values” of email use in the workplace and look at areas for improvement in the use of email for both sender and receiver that will give a significant improvement in its effectiveness and efficiency with respect to employee time.

This thesis has covered the cost-effectiveness of email within the workplace. The main aims of this thesis are to answer the following questions.

1. How can the cost-effectiveness of email use be determined?
2. How can the cost-effectiveness of email use be improved?

In the terms of this thesis “cost-effectiveness” has meant the resulting costs of using email. The word “cost” in “cost-effectiveness” has been broken down into two parts.

1. “Soft” Costs



These costs are difficult to measure. They include, for example, the social impact of using email in the workplace or the social learning that is gained through using the email system.

## 2. “Hard” Costs

These costs are easier to measure. They include, for example, the amount of time employees spend using an email system or the cost to employ an employee in terms of wages per month.

To move towards these aims the specific areas of this research have been defined as follows.

1. To examine the “hard costs” of email use in a case study of a working environment to gain a better understanding of how email is used.
2. To quantify, in a case study, the level of interruption to an employee’s work caused by email, including any associated interrupt recovery time.
3. To develop, using the experience of the case study, ethical guidelines for monitoring employees’ use of electronic communication.
4. To develop an email usage costing formula, based on the “hard costs” and interrupt data obtained, to help focus on optimising the email system for maximum effectiveness and efficiency with respect to employee time.
5. To determine if the email software used can be modified to encourage users to produce more effective communication.
6. To develop guidelines for managing electronic communication within the workplace to improve email use and to give greater effectiveness and efficiency with respect to employee time.
7. To determine what employee training would give greater effectiveness in the use of email and efficiency with respect to employee time.



Various chapters within this thesis have set about trying to achieve these objectives. The next few sections will conclude how each objective has been tackled and achieved. Of course, whenever trying to solve a problem questions are inevitably raised. Some of the questions raised during the research are still unanswered and form the basis of the future research section in this chapter.

## 9.2 Understanding Email Interactivity

The research into the “hard costs” of email usage has allowed a better understanding of email communication and email interactivity within the workplace. The Danwood Group, who were involved in the case studies, know substantially more about their employees and how they interact with the email system. For example, they know how much business and non-business email is dealt with a day; the time it takes an employee to respond to a new email; the time it takes to recover from an email interruption, and that there are four natural email communication periods throughout the day. The findings at the Danwood Group are unlikely to be dissimilar to a company of comparable size, which make the findings a valuable asset to a number of companies.

## 9.3 Email Interrupt Recovery Time

The research into email interrupt recovery time has found that the employees at the company allowed themselves to be interrupted almost as frequently (every 5 minutes) as with telephone calls. The common reaction to the arrival of an email was not, as is often assumed, to delay the response to a time that is more convenient to the user but to react within 6 seconds. This means the interrupt effect is comparable with that of a telephone call. The recovery time from an email interruption is, at 64 seconds, significantly less than the published recovery time of 15 minutes for a telephone call. The research has shown that there is an interrupt recovery time associated with email and it is concluded that, while email is still less disruptive than the telephone, the way



the majority of users handle their incoming email has been shown to give far greater interruption than expected.

#### 9.4 Ethical Guidelines to Monitoring Employees

Throughout the whole of this thesis, electronically monitoring employees has been the primary way of obtaining data. It was decided at the start of this research that monitoring would be far more effective than other means of collecting data. For example, surveys rarely produce accurate results, as they are an indication of what people think and not necessarily what actually occurs. With a number of studies involving monitoring (Chapter 6, Chapter 7 and Chapter 8) it was possible to assess what was ethically acceptable to employees and employers and to write a set of ethical guidelines which are described in Chapter 4.

It was found to be important to the employees to know that another employee within the same company did not carry out the monitoring. As a full time PhD student at Loughborough University, the author had an independent status that was more acceptable to the employees being monitored. This independence is likely to give more accurate results if employees know that information about individuals will not, except in extreme circumstances, be passed on to their managers. It is suggested that other companies would benefit from contracting any monitoring of employees' use of email and the Internet to an independent outside body.

#### 9.5 Email Usage Costing Formula

There are many “soft” and “hard” costs associated with email. An example of a “soft” cost is the cost of using email for social networking. Examples of “hard costs” are the cost of the hardware to run the email system, the cost of the software (email server and clients), the cost of maintaining the system and the cost of employee time to use the system. As far as the author is aware no research has been carried out into the “hard”



costs of using an email system, in particular the cost of email interaction. In Chapter 6 of this thesis a detailed study was carried out into employee email interaction. From the results of the study it was possible to calculate an email costing formula for an email system in different stages of its lifecycle. The formula emphasises the overall “hard” costs of employee interaction with the email application and excludes the costs of hardware, software and maintenance. The formula highlights the excessive costs being incurred by the Danwood Group and as a result it was possible to identify ways for the Danwood Group to save money and increase employee effectiveness.

- The one-line email system was introduced to help increase employee effectiveness through the employee creating shorter and more structured email messages (Chapter 7).
- A set of guidelines were introduced to help reduce the number of interruptions an employee receives a day, which should help the employee to become more productive (Chapter 8).
- The need for employees to receive email application training to become more efficient and effective was determined (Chapter 8).
- A monitoring policy was introduced that is beneficial to both the employee and employer. The policy also helps reduce resentment felt by the employees of being monitored (Chapter 4).

Through being able to show part of the “hard” costs of email interaction to employers it was possible to identify where further research is necessary to increase electronic communication effectiveness and to cut the cost of email interaction, and as a result to increase employee effectiveness.

## 9.6 Email Training

After monitoring employees using email it was realised that a large proportion of the emails written could be constructed in just one line of text. There are many benefits of



receiving a one-line email as it makes replying easier and saves time. Trying to get employees to write an email in one line would be difficult unless significant training is administered. To get round this problem a special one-line email application was written to help train employees while in their usual working environment. Chapter 7 shows how the application was created and the effect on the employees using it. The application showed that suitable email software can have the affect of training users to produce more succinct and better structured emails. This training is achieved by a more effective and successful means than traditional training methods. However, the research in the thesis has also shown that traditional training methods are still required to educate employees about using the email system. Through traditional training employees can also become more cost-effective. Training is required on the basic skills of using an email client; for example, employees should set their email applications to check for email less frequently than every 5 minutes, which the majority of employees have their email application set up to do. This will reduce the number of interruptions they receive a day and make the employee more aware of the effects of interruptions on both themselves and their colleagues throughout the day.

The outcome of the research has shown that, through a combination of both training through software and traditional training methods, companies can encourage employees to become far more cost-effective in terms of their email usage throughout the day.

## 9.7 Guidelines for Managing Electronic Communication

Through analysing employees using email it was clear that employers required usage guidelines for managing electronic communication interaction. Chapter 4 contains information on the importance of obtaining e-satisfaction within the workplace. A fine balance must be struck if employees are to feel valued and for employers to have a satisfactory level of employee productivity. As a result of the case studies at the Danwood Group it was possible to derive a set of policy guidelines for managing



electronic communication from both an ethical and a usage viewpoint, and these are given in Chapter 4. In addition to those guidelines, Chapter 8 offers advice on how to improve employee effectiveness through training and changing the configuration of the employees' email system to minimise interruption to employees' normal working procedures. It is suggested that any company that implements these policies and configuration guidelines should be able to minimise email usage costs and increase employee effectiveness.

## 9.8 Summary

The research in this thesis has significantly contributed to four areas of research. Firstly it has provided an internal email costing formula to calculate the "hard costs" of interacting with an email system, which can help companies determine how much they are spending on email communication. Secondly, it has produced electronic monitoring guidelines that help bridge the gap between employees and employers and take into consideration the ethics behind monitoring. Thirdly, it has produced a tool that enables employees to become better email communicators through constructing more meaningful emails. Finally, it has provided organisations with a set of email usage guidelines which highlight the need to reduce the number of email interruptions an employee receives a day.

Overall the hypothesis has been proven by these four research contributions. Both sender and receiver can gain significant improvement in their effectiveness and efficiency with respect to employee time if they follow the email usage guidelines. They can also become more effective if they develop better email communication skills through using the one-line email system and can become more efficient through understanding the effect of email interruptions.



## 9.9 Recommendations for the Danwood Group

The research has highlighted a number of areas where the Danwood Group could become more cost-effective. It is recommended that the company review their current email monitoring policy and incorporate the e-policy guidelines set out in Chapter 4. Particular attention should be given to both the employees and employers working together to creating the new e-policy. The emphasis of any monitoring should be made clear and should only be done to increase the quality and effectiveness of work, not for criticising individuals. It must be made clear to employees that sackings or other disciplinary actions will not be made directly as a result of the information gained from electronic monitoring except in the well-defined case of an extreme breach of the agreed e-policy. Above all the e-policy should be kept simple so that employers and employees can understand it.

Once the electronic monitoring policy has been put into place the Danwood Group can focus on helping their employees to become more effective. It is recommended that the Danwood Group continue to monitor their employees to identify if the email training administered by the company has had an affect. The training given by the company should be based around the findings from the research and in particular the email usage guidelines defined in Chapter 8. For example, it could show how interruptions can make employees less effective, and how simply changing the email client to check for email every 45 minutes, instead of every 5 minutes, would lead to a more non-interrupted and effective day.

Finally, it is recommended that the Danwood Group expand the one-line email system, as detailed in Chapter 6, throughout the company. This would increase employee effectiveness through the employee creating shorter and more structured email messages. All of the recommendations mentioned above could enable the Danwood Group to become a more effective company in terms of their email communication.



### 9.10 Recommendations for Other Companies

The research within the thesis has been specific to the Danwood Group; however, recommendations can still be made to other companies to increase the effectiveness of their employees. It is recommended that companies look at their monitoring policy and ensure that it incorporates the guidelines set out in Chapter 4. This will then give a company a good foundation from which to build in order to increase their employee effectiveness.

The company should then start to monitor employees to find out how they are interacting with the system. It is expected that the majority of the employees will not be too dissimilar to the Danwood Group employees, in which case the email usage guidelines in Chapter 8 can be used. The guidelines highlight what employees need to do to become more effective at email communication. It is recommended that the employees be given training on the guidelines. Constant monitoring of the employees will determine if the training has affected the employees email communication.

Like the recommendations for the Danwood Group, it also recommended that companies introduce a way of communicating through a one-line email system to help increase employee effectiveness, through the employee creating shorter and more structured email messages. If all of the above recommendations are adhered to a company should find improvements in their employee effectiveness and a return on their investment in monitoring their employees.

### 9.11 Recommendations for Further Research

There are a number of suggestions for further research that can build upon the results of this thesis, and in particular on the second aim of this thesis, which is to determine how the cost-effectiveness of email use can be improved. The first aim of the thesis is difficult to achieve as it involves a number of “soft” costs. “Soft” costs are difficult to capture, as they are difficult to measure and much of the data gained doesn’t actually fit



into a known measurement. The further research section has been split into two parts: the first section looks at determining the cost-effectiveness of email which is more concerned with “soft” costs, and the second section looks at improving the cost-effectiveness of email which is more concerned with “hard” costs.

#### *9.11.1 Determining the Cost-Effectiveness of Email Usage*

- Research needs to be carried out to establish how many and what proportion of non-business emails are beneficial to an employee at work and when too many non-business emails start to affect the employee’s work. The amount of non-business email an employee can cope with is going to be specific to individual employees. However, there may be a correlation between the number of non-business emails an employee can cope with and his or her job role. By establishing how many non-business emails per day employees can receive without affecting their work, it may be possible to keep the level of non-business use within optimum limits.
- Research is required into the correlation between employees with different positions within an organisation and how they deal with interruptions. For example, administrative staff might deal with interruptions more efficiently than the directors of the company. The complexity of each interruption also needs to be taken into consideration when analysing the results. Depending on the results there may be different job roles that deal with interruptions more effectively and efficiently. The results could possibly determine where an employee would be best suited to work within the company and this could potentially maximise the company’s effectiveness.
- To determine the true cost-effectiveness of email it has to be compared to other communication media, such as memos, letters, telephone calls and face-to-face encounters. Trying to determine the cost-effectiveness of these other media is near impossible due to the “soft” costs involved and the difficulty in tracking



non-electronic media like memos, letters and face-to-face encounters. However, the information can be gained from less accurate data capturing methods, for example surveys and interviews. If the data can be captured it can be compared against the email data already gained from this thesis to determine the cost-effectiveness of email compared to other media.

- Further research is required into telephone interrupt recovery times. DeMarco's research was carried out in 1977 and only looked at the telephone interrupt recovery times for software developers. As technology has moved on, research needs to be carried out into the time it takes the different job roles within an organisation to recover from a telephone interrupt. By determining the telephone interrupt recovery time for employees, an indication of the time that could be saved if employees decided to use email instead of the phone for some of their communications could be established.
- Research is required to determine the effectiveness of email compared to other media for social networking. This research may be near impossible due to the complex "soft" costs of determining the goals of social networking and capturing the data for example, from face-to-face encounters which happen in many different places throughout the day. However, if the data can be captured it can be determined, through comparison, how cost-effective email communication is compared to other media when it comes to social networking.

#### *9.11.2 Improving the Cost-Effectiveness of Email Usage*

- It would be beneficial to replicate the studies and observe whether or not the findings in this thesis could be reproduced in other working environments. Although it is believed that the Danwood Group provided a typical office environment, further case studies are needed to verify this. It would be useful to solicit a similar number of individuals from different industries to validate and



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verify the results in this thesis. It may be useful to learn if the findings are in line with the particular nature of business within each job type. For example, are sales personnel different from accountants or are managers different to clerks? This kind of information might prove helpful in providing industry-specific training in the future for organisations that wish to improve the email communication skills of their workers.

- To help employees cope with the large number of emails they receive a day, it would be useful to construct an intelligent email inbox assistant. The program would learn the employees' patterns of how they deal with incoming emails. Identifying the sender and what the email contains would determine if the inbox assistant should instantly interrupt the employee or wait for a more convenient time. This program would help manage interruptions throughout an employee's day and, in turn, increase employee effectiveness throughout the organisation.
- Communication patterns require further research to try and establish how to increase employee effectiveness by finding the best time to communicate during the day to keep interrupts to a minimum. As part of the research, companies could be asked to experiment and encourage the majority of communication to take part during the four natural email communication peaks, as discussed in Chapter 8, to help reduce employee interrupts and to reduce the risk of message fatigue.
- Research is desirable into the effect email feedback groups might have on employee effectiveness. To improve email effectiveness, email feedback groups could be introduced and the outcome monitored on an employee basis. An email feedback group is where employees could post hints and tips on using the email system to their colleagues to help them become more effective at email. Through the self-learning environment, employees might be more receptive to



the new ideas of how to use the email system more effectively, rather than being told how to use the system in a training room environment.

- As part of the research of this thesis a set of Email Usage Guidelines were produced (see Chapter 8). Due to time constraints the author was unable to implement the guidelines and test them to see if they had an effect on employee effectiveness. It is suggested, as a part of further research, that these guidelines are introduced through an email workshop. The employees that are to take part in the workshop would have their email habits monitored before and after to determine if there has been an increase in employee effectiveness.

## 9.12 Conclusions

Research has been slow to identify the specific factors that influence email effectiveness. Individuals can gain not only from becoming aware and learning these specific factors that constitute email effectiveness, but also from understanding how recipients tend to react to these factors under different situations. As the use and acceptance of email continues to grow, so too will the need for organisations to realise that the ineffective communication habits of their employees will reduce their effectiveness. The millions of pounds invested in information technology and in unfocused training is no match for the hidden cost of email effectiveness.

Overall this thesis has managed to establish that the costs of using email can be determined in terms of employee time, and has shown how this can be achieved. The results have been interesting and informative and have led to a much greater understanding of how email is used. It has also been possible to build on this understanding by identifying how electronic communication can be improved. Some ideas were tried and tested at the Danwood Group and found to be capable of reducing the communication cost. From the studies and experiences it was possible to produce



guidelines for email use that should enable companies to improve the electronic communication process and as a result improve employee productivity.

As this study has brought to the surface factors that have not been addressed elsewhere in current literature, the author believes that the findings make a significant contribution to the understanding of electronic communication. As explained in this chapter the author's four main research contributions have been:

- internal email costing formulae;
- electronic monitoring guidelines;
- one-line email applications;
- email usage guidelines.

The author's research has made contributions to both academia and industry. The author has produced seven conference papers and one journal paper, which are detailed at the beginning of this thesis. The author has had one of the leading figures in the information systems area, Tom DeMarco, commend his journal paper and comment "What a delicious paper!".

While the author has been undertaking the PhD there have been many enquires from industry regarding the research. For example such companies as IBM, SAI Corp., Wyndham International, CollabraSoft, Model Technologies Inc, TTYL, Telefiber, and Mainspring Inc., have contacted the author via his web site. Alexander Lowry from Mainspring Inc. after reading the author's research wrote a letter regarding the usefulness of the research. The letter can be seen in Appendix 4, but the following is an extract from the correspondence: "There should be no question as to the value gained from his insightful research".

The research outlined in this thesis can help companies similar to the one studied to become more effective in their email communication. The four main research areas can enable email senders and receivers to gain significant improvement in their



effectiveness and efficiency with respect to their time at work, which has made a significant contribution to the second aim of this thesis. The research has also made a significant step towards the first aim of this thesis, by determining the cost-effectiveness of email and making a substantial contribution to identifying what “soft values” require further research to determine the true cost of email.



Appendix 1

SMS Questionnaire



**SMS Questionnaire**

This questionnaire is to find out how you use the short message service that has been added to Outlook 2000, it is to find out whether you find it useful and use it as an alternative to sending a regular email.

- The questionnaire is completely anonymous.
- Please tick in the box the answer(s) that apply to you.

**Question One:**

Do you use the SMS button to send short messages to colleagues?

- ☐ YES (If Yes please go to Question Three)
- ☐ NO (If No please go to Question Two)

**Question Two:**

Why don't you send SMS messages to colleagues?

- ☐ Desired recipients are not on the SMS address list.
  - ☐ I prefer to send a regular email, Why? .....
- .....

Other (Please Specify.....)

**Question Three:**

When you need to send a message to a colleague, do you routinely select the SMS button to send that message?

- ☐ YES
- ☐ NO



**Question Four:**

Do you find being able to send a short message instead of a normal email useful?

- ☐ YES
- ☐ NO

If you answered YES, why is it useful? (You may tick more than one)

- ☐ Quicker to write
- ☐ More efficient than a regular email
- ☐ An SMS message is replied to quicker
- ☐ The different icon denoting an SMS message is useful

If you answered NO, why is it not useful? .....

.....

**Question Five:**

Is an SMS message clearly visible in your Inbox when one has been received?

- ☐ YES
- ☐ NO

**Question Six:**

Do you use the SMS service for personal use, business use or both?

- ☐ Primarily for Business Use
- ☐ Primarily for Personal Use
- ☐ Both

**Question Seven:**

Do you read an SMS message from your Inbox, or do you double click to open the SMS message?

- ☐ I read it from my Inbox
- ☐ I open the SMS message by double clicking on the message?

**Question Eight:**

When replying to an SMS message do you normally remove the prefixed SMS: from the message box?

- ☐ I remove the SMS: prefix
- ☐ I leave the SMS: prefix



**Question Nine:**

Are there any improvements to the SMS service that you would like to see?

.....

.....

.....

**Question Ten:**

Apart from the issue that was raised regarding Outlook asking how you would like to connect to your server, have there been any other problems or issues?

.....

.....

.....

Are there any other comments that you would like to add?

.....

.....

.....

Please feel free to email me at [Brettjo@hotmail.com](mailto:Brettjo@hotmail.com) for any queries or concerns.



## Appendix 2

### Employee's Email Interaction Form



## Appendix 2

Name :

Date :

**Job Title :**

[illegible]



A look up table (shown below) was created so shorthand could be used when recording details from the videotapes to paper.

Ax	Attached file(s)
CO	Close outlook
EC	Email Closed
ECM	Email Checked Manually
EM	Email Minimised
I	Information
LO	Launched outlook
MAO	Max outlook
MIO	Min outlook
NMA	New Mail Arrived
Q	Question
RBE	Read business email
RI	Reads Inbox
RNE	Read non biz email
RSPI	Response Instant
SC	Starts Computer
SE	Sends Email
VOE	View Old Email
WBC	Write business email
WNE	Write non-biz email



## Appendix 3

### Samples of Communications Received During PhD



The following are some of the emails that have been received from users of the author's web site which contains information about his research.

**~oOo~ New Email ~oOo~**

Tom,

What a delicious paper (The Cost of Email Interruption)! What are your plans for it? Let me know if I can help getting it prominently placed.

Best,

Tom DeMarco

=== **Tom DeMarco**, The Atlantic Systems Guild: [tdemarco@systemsguild.com](mailto:tdemarco@systemsguild.com) ===  
<http://www.systemsguild.com/>

**~oOo~ New Email ~oOo~**

Dolly,

Many thanks for your email.

Tom Jackson a PhD student has been conducting research into email at Danwood. I have sent a copy of your email to him in order that he can tell you how to get the information you require.

Best wishes,

Darren Wilson  
Information Systems Director  
The Danwood Group Ltd.

-----Original Message-----

From: Dolly Borsato [mailto:[dborsato@lib.uwo.ca](mailto:dborsato@lib.uwo.ca)]

Sent: Friday, July 13, 2001 2:43 PM

To: Shaana Tomlinson

Subject: Study which was conducted regarding email use in your firm

Hello



I am writing to you on behalf of one of the professors in the Ivey School of Business at the University of Western Ontario , London, Ontario Canada. Christina Cavanagh is doing considerable research on the effects of e-mail in the workplace. As a result of her research she ran across a small item indicating that a study had been conducted among the employees of your firm.

Would you please be able to tell me by whom the study was conducted and a method by which I could obtain a copy?

Many thanks for your assistance.

Dolly Borsato-Vassal

Hi Tom...Many thanks for providing me with the "keys to the kingdom" <grin>...Your team's work looks very interesting... Cheers, Chris

**~oOo~ New Email ~oOo~**

Hi Tom,

I've been searching high and low for a solution like your winvnc.exe! However, when I click on the link to download I get an error stating that the page can't be found. Any help you could provide would be very much appreciated.

Thank you  
Kathy Petersen  
Software Technician  
Lloydminster Public School Division  
Lloydminster, SK CANADA

**~oOo~ New Email ~oOo~**

I have had a look at your site and am looking for a way to monitor all the mails sent and received etc from all of the mailboxes on my exchange server...the link for more information on your site does not have anything, can you please help?

Garth Fraser  
IT Infrastructure



Tel: +44 (0) 1256 340845  
Fax: +44 (0) 1256 818022  
Mob: +44 (0) 7989 490027  
InSource ITC Limited  
Norden House  
Basing View  
Basingstoke  
RG21 4HG  
<<http://www.insource.co.uk>>

**~oOo~ New Email ~oOo~**

I would like to know about your researches - also would collaborate if you would like me to.

Thanks

Ellen Morton  
Marketing Manager  
Stor~Wave Computer Solutions

tel. 01252 401046 (direct line)  
Mobile: 07881 810515

<http://www.stor-wave.co.uk>

**~oOo~ New Email ~oOo~**

Hi Tom

I hope you are keeping well - I was wondering whether or not I could bother you again for some information on email from your research. I am specifically looking for evidence of increased use over the past couple of years of email signs that it will continue. If you have this stat I would be most grateful.

The reason why I am looking for this kind of thing is for a client of mine - would it be possible for you to send me some background on yourself as if you are one of the leading experts in this field there could be a possibility for commissioning work to you.



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Matthew Estwick  
Consultant

Kaizo  
66-68 Margaret Street  
London W1W 8SR  
Telephone +44(0)20 7580 8852  
Direct Line +44(0)20 7612 8545  
Fax +44 (0)20 7580 5035  
E mail [matthew.estwick@kaizo.net](mailto:matthew.estwick@kaizo.net) <<<mailto:deborah.cotier@kaizo.net>>>  
Internet [www.kaizo.net](http://www.kaizo.net) <<<http://www.kaizo.net>>>

Kaizo - communicating difference

**~oOo~ New Email ~oOo~**

Hello from sunny Calgary, Alberta at the foot of the Rockies!

I'm a grad student doing a Master's project on future development of a large public sector organisation's intranet, and am wondering if I might have access to your related papers for possible inclusion in my own research?

Have a good day -

---

Ann Nosen - tel 403.268.4674 -  
e-mail [anosen@gov.calgary.ab.ca](mailto:anosen@gov.calgary.ab.ca) - Advisor, Customer Service  
and Communications -  
City of Calgary - PO Box 2100, Station M - Calgary, AB  
Canada T2P 2M5

**~oOo~ New Email ~oOo~**

Good Morning Mr. Tom Jackson,

I am interested in reading your findings on email and its benefits to any organization.

Thank you



Elena M Gonzalez  
elena@pinehurst.net  
NC Regional Office  
800-394-1529  
910-695-1205 Fax

**~oOo~ New Email ~oOo~**

Tom:

Greetings! I am researching the pervasiveness of email for a project. I found your home page graph on Communication Time/Year interesting and had a couple questions.

--Hours seem low for a yearly basis--only 54 hours/year on business email. What type of employees were included in this study? Executives? Laborers? Professionals? Seems like this should be per month, not per year!

How do I request access to the papers & journals articles on your site? They seem interesting, esp. in light of my project. Anything you can do to help me research this topic would be greatly appreciated!

Mary Hain  
Hain Communications  
[hainpr@pacbell.net](mailto:hainpr@pacbell.net)  
925-926-0326  
c 925-366-9409  
f 925-926-0381

**~oOo~ New Email ~oOo~**

Dear Tom Jackson,

I am a researcher working for NTT (the equivalent of ATT) in Japan. I am beginning to do some research in the area of email and recently came across your website. My focus is a bit different; I am looking at email from the point of view of its unique



characteristics with respect to the automatic translation system that we have developed in our lab. I understand that this is something of a long shot, but I am writing to ask if you have come across any work on this kind of area, or on the discourse or linguistic characteristics of email in general. (By the way, I wonder if you would get a different picture of email use in other countries? As an American researcher, I know I depend heavily on email for contact with researchers outside my own lab, as do many of my Japanese colleagues.)

Thanks for any help you may be able to give me. Sorry to take up your time.

Laurel Fais

--

NTT Communication Science Laboratories  
2-4 Hikaridai, Seika-cho  
Soraku-gun, Kyoto 619-0237  
Japan  
phone: +81-774-93-5316  
email: [fais@cslab.kecl.ntt.co.jp](mailto:fais@cslab.kecl.ntt.co.jp)

**~oOo~ New Email ~oOo~**

Mr. Jackson-

I am researching the cost of sending an email. I believe the number to be slightly above \$0.00. I came across your articles in my search. I would gladly sight your work but unfortunately I am unable to access your database.

I was hoping that you might have a figure that I could site in my work. Please contact me at your earliest convience to discuss this matter. My phone number is listed below or I may be reached via email.

Thanks for your time and attention.

Alex

---

Alexander Lowry  
Mainspring, Inc.  
404 Fifth Avenue, 8th Fl  
New York, NY 10018  
[www.mainspring.com](http://www.mainspring.com)  
[alowry@mainspring.com](mailto:alowry@mainspring.com)  
Phone: 917.438.3781  
Fax: 917.438.3881



## Appendix 3

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December 12, 2000

To Whom It May Concern,

I am writing in support of Mr. Tom Jackson's PhD candidacy. There should be no question as to the value gained from his insightful research. His groundbreaking work was of extreme importance to a recent project of mine. While confidentiality agreements prevent me from revealing any details about my client or the deliverable that I prepared, I am able to recognize the part which Mr. Jackson's work played in the successful completion of my project.

One of the many tasks with which I was charged on my project was to uncover the cost of sending an email. While I believed the cost to be slightly greater than \$0.00, I was unable to locate any information that supported my thesis. After numerous exhaustive searches, I was able to find only a handful of data points which, when tied together, revealed the decreasing cost of email since its invention. However, despite my extensive research, I was unable to conclusively prove that the cost of sending an email.

At long last I discovered Mr. Jackson's work. I contacted him immediately and as any astute academic, he was eager to share his work. His research was instrumental in upholding my thesis as his exhaustive studies clearly indicated that the cost of sending an email is low when compared to using the telephone. His reams of data and finely crafted prose were easy to decipher. I was able to leverage his studies in my own work.

I strongly urge you to acknowledge the insightful work that Mr. Jackson has completed thus far. There should be little question that his thesis proves the viability and significance of the latest, most important form of communication. Email has already become central to the lives of virtually every individual and its effects on society will be far reaching.

Society would do well to examine the benefits of this technology in relation to its price relative to that of other forms of communication. I am pleased that Mr. Jackson has endeavoured where few have yet to tread. I hope that you too will recognize the necessity of his work.

Sincerely,

Alexander S. Lowry  
Mainspring, Inc.  
404 Fifth Ave, 8<sup>th</sup> Fl  
New York, NY 10018



## Appendix 4

### User Guide for the Danwood SMS Email Application



## Using the Outlook 2000 Short Messaging Service

On your Outlook 2000 toolbar you will see the SMS button, which is to be used to send short messages to colleagues.

The SMS service has been designed for you to use internally within Danwood and will work between the two buildings on the Danwood campus to configured Outlook 2000 users.

The first section of this User Manual explains the basic "How To" whilst on page 3 offers guidelines on troubleshooting any issues you may have. There is also an explanation regarding the recent issue that you may have been experiencing.

### Using the SMS Service

- The following figure illustrates the Outlook 2000 toolbar with the SMS button:

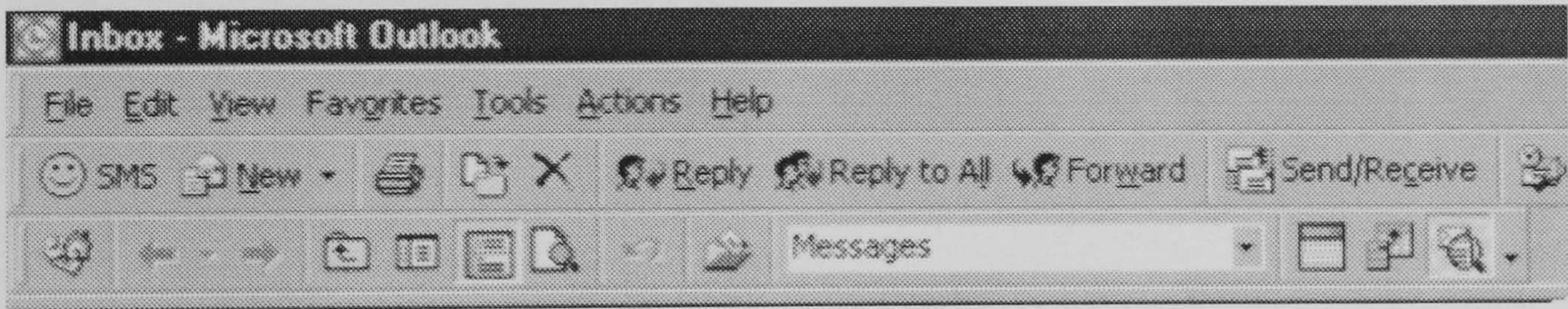


Figure 1: Outlook 2000 Toolbar

- Clicking the SMS button will open the following form:

A screenshot of a window titled "SMS: - DanwoodSMS (Rich Text)". The menu bar includes "File", "Edit", "View", "Insert", "Tools", "Actions", and "Help". The toolbar contains icons for "Send", "Print", "Cut", "Copy", "Paste", "Undo", "Redo", "Find", "Options...", and a help icon. Below the toolbar, there is a "To..." button and a text input field. Below that is a "Short Message:" label followed by a text input field containing the text "SMS:". At the bottom right of the window, it says "Short Message Service for Danwood".

Figure 2: The SMS Form



Clicking on the **To..** Button will display a list of users who have access to the SMS service, it is advisable that you select the recipient in this way to ensure the correct SMS email address is used.

- The recipients SMS email address is **SMSfirstname.surname**

You must use the above address to send an SMS message rather than **firstname.surname@danwood.co.uk**

In the short message text box, type your short message after the prefixed SMS: and then send the short message. Leaving the SMS: prefix in the short message will notify recipients they have received a short message.

The recipient will receive the short message in their Inbox as illustrated below:

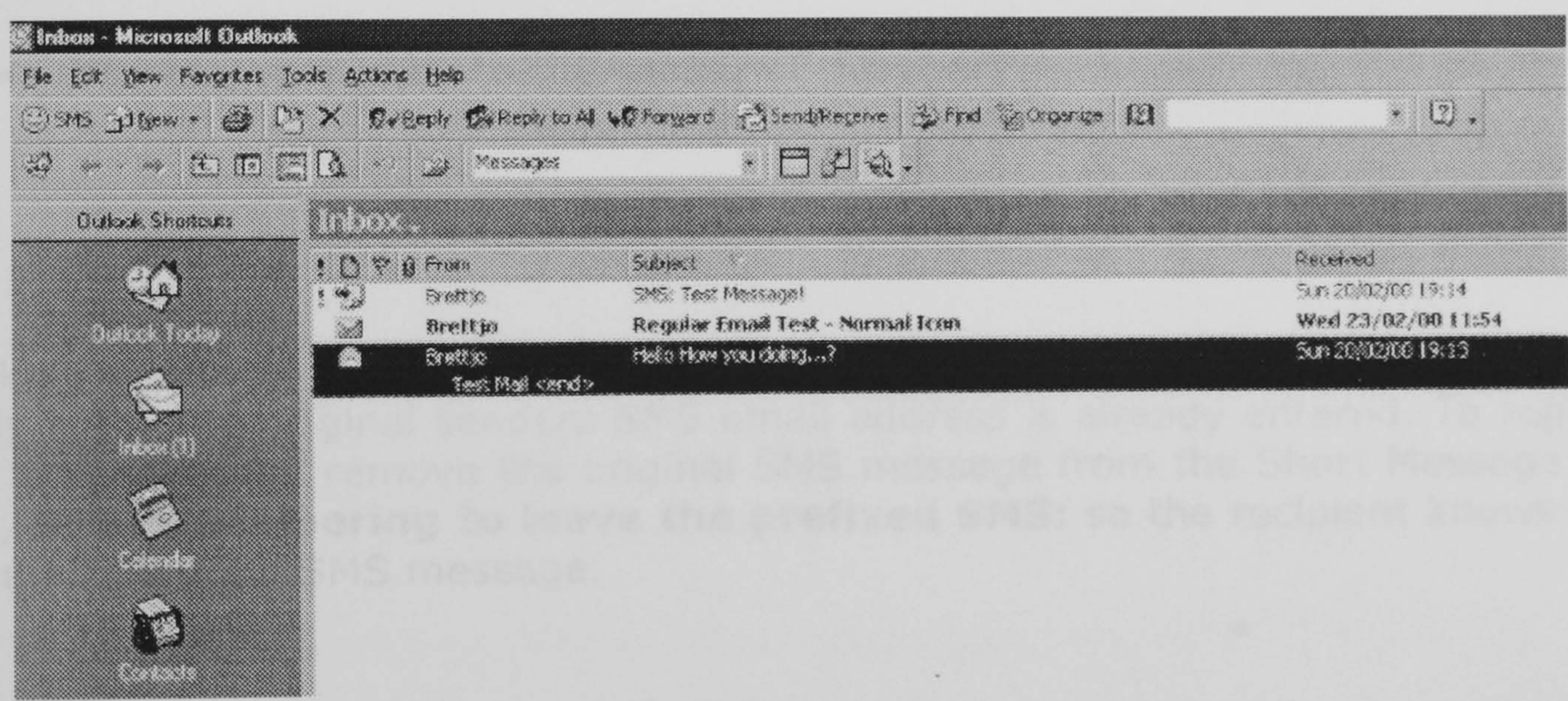


Figure 3: Inbox with a Short Message

The short message is flagged high priority and uses a different icon to illustrate an SMS message has been received.

The short message is displayed in the subject field, therefore you do not have to double click and open the message to read it. If you do open the short message, it is displayed in the following form:



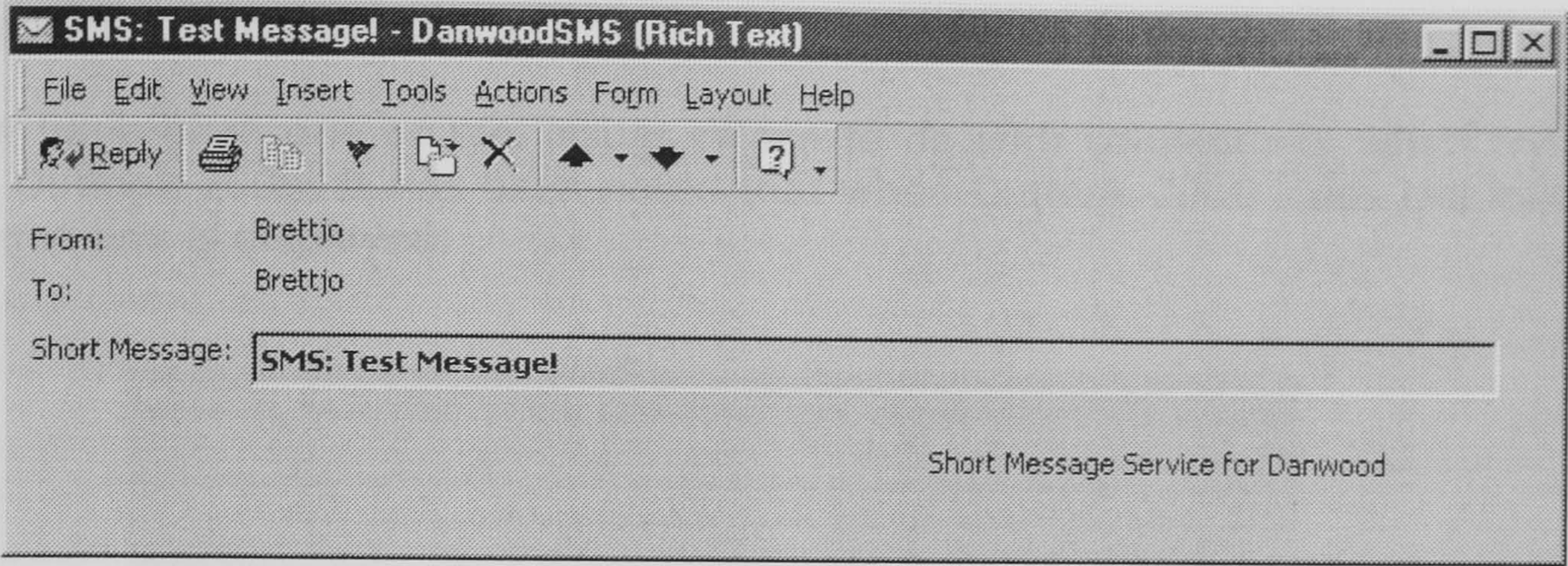


Figure 4: Form used to open and read an SMS message

Replying to a SMS Message

- You can only reply to the sender of the short message

You can’t reply all or forward using the Short Message Service.

Clicking the Reply button will open the SMS form (as Figure 2 illustrates) for you to reply with. The original senders SMS email address is already entered. To reply to the SMS message remove the original SMS message from the Short Message text box, **but remembering to leave the prefixed SMS:** so the recipient knows they have received an SMS message.

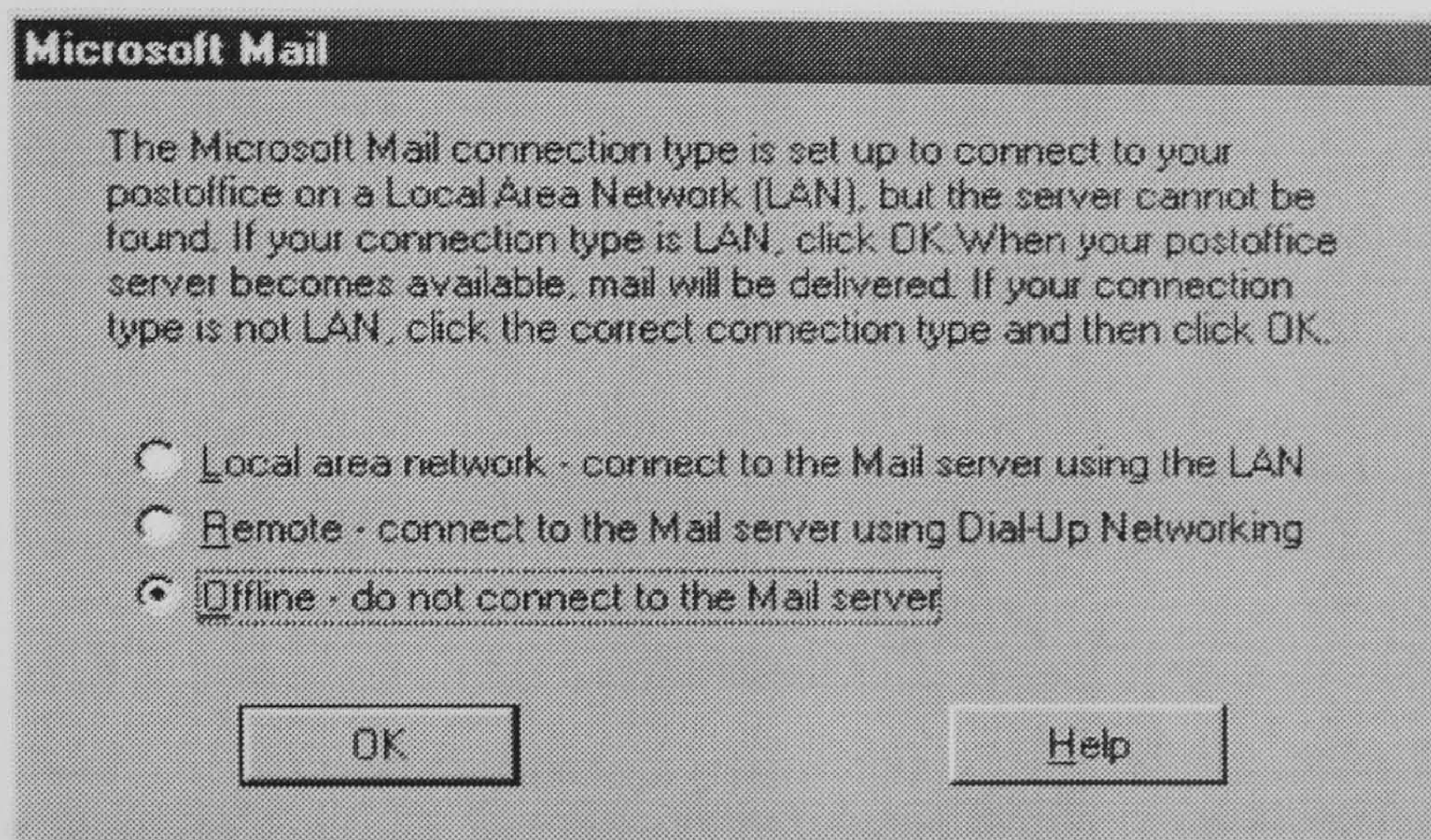
- You can’t attach files to a short message.

To send an attachment you need to send a regular email to your recipient / colleague using their normal email address i.e. **firstname.surname@danwood.co.uk**



## Troubleshooting Issues

There have been one or two issues raised to do with connectivity when trying to start Outlook 2000. It has been noted that when Outlook 2000 loads the following dialogue box is displayed:



**Figure 5: SMS Error Message**

If figure 5 is displayed then the correct workaround is to set the Mail Server to Offline. The reason why this is displayed is because Outlook 2000 can't find the SMS Mail Server on the network, if in the future you do see this then please inform me at [Brettjo@hotmail.com](mailto:Brettjo@hotmail.com)

Setting the SMS service to Offline will not stop regular email functionality.

Once successfully connected the SMS Mail Server (successful connection is evident when figure 5 isn't displayed) the Post Address list will be available.

It has also been noted that the first time the SMS button is pressed it can take a short time for the SMS form (figure 2) to be displayed, this is due to the form being loaded into memory. Subsequent attempts will result in a much quicker display time.

If you have any further questions or queries then please let me know at [Brettjo@hotmail.com](mailto:Brettjo@hotmail.com)

Thanks for your patience.



## Appendix 5

### Specification for the Danwood Mail Application



### **The Danwood Mail Specification**

The Danwood Mail application is to replace the Microsoft Windows Messaging application at the Danwood Group's head office. The Danwood Mail application is to monitor employee's interaction with the system and record the details on their local machine.

### **Specification**

- To enable employees to have the basic email functions that are provided in the Microsoft Windows Messaging application. These are to send, receive, compose, delete, print and edit emails.
- The email application is to be client side and support the POP3 protocol.
- The Danwood Mail is to record employees every interaction with the email application.
- There is to be a multi-purpose window, which will be used to read and compose messages. The application is require to record every detail about the window including the amount of time the window has user focus.
- The window has focus when the user is interacting with it and the user can determine this by the shade of the title bar, which is a standard function of the Microsoft Windows operating system
- All the data captured from the application is to be stored on the client side machine and a new file is to be created every day with the days date as the filename.
- The first line of the file will contain how many entries have been made into the file.



- The file is to be Comma Separated File with multiple columns e.g.  
5,8,"Glug!","Clare White","Bob Allan",53,"08:24:04","","","05-04-1999","Clare White"
- The information in the first column determines the type of email message: 4 means delete email, 5 read email, 6 write email, 7 reply to email, 8 forward email and 9 reply to all on the recipients list.
- The information in the second column is the time in seconds it takes the user to carryout the email interaction.
- The information in the third column shows the subject line of the email.
- The information in the fourth column contains the recipient.
- The information in the fifth column contains the sender.
- The information in the sixth column contains the number of words in the main email body.
- The information in the seventh column shows the time of day the email interaction took place (hh:mm:ss).
- The information in the eighth column shows the number of attachments.
- The information in the ninth column contains whom the email has been carbon copied to.
- The information in the tenth column contains the date and time when the email interaction took place (dd/mm/yy hh:mm:ss).
- The information in the eleventh column stores the name of the person who is using the Danwood Mail on that particular machine.
- The twelfth and final column stores the type of message, which is either "O" for other, "B" for business or "U" for unknown. The type of message is to be set by the user. If an incoming email is not "B" or "O", then it is set to "U".
- The deletions of emails are to be logged but not timed, as the time taken is deemed insignificant as it is only a key press / mouse click.



- The Danwood mail application is to run on the following operating systems:
  - Microsoft Windows 95
  - Microsoft Windows 98
  - Microsoft NT Server 4.0
  - Microsoft NT Workstation 4.0



## Appendix 6

### Specifications for the SLMail Metrics In and the SLMail Metrics Out Applications



**SLMail Metrics In and SLMail Metrics Out Specifications**

The applications are to monitor every employee’s email by analysing the files in the mail out and the mail in folder on the SLmail server. The application has to work on the server side and also work with the mail server called SLmail from Seattle Labs. SLmail conforms to the open Internet standards and works with any email client that supports standard SMTP (Simple Mail Transport Protocol), ESMTP (Extended Simple Mail Transfer Protocol), or POP3 (Post Office 3) Internet protocols, including Quickmail Pro, Eudora, Agent, Pegasus, Z-Mail, Netscape, and Microsoft Outlook. The SLMail Metrics In application is to record details from incoming email. The SLMail Metrics Out application is to record details of outgoing external email.

**Specification**

- The application is to copy a mail file to a local folder to avoid locking the file on the mail server.
- The application is to open the copied mail file associated with the employee and extracted details and entered them into a text file in the root directory as shown by a file extract:

```
O  "From-<lesley.chaple@danwood.co.uk>", "To-  
  <sue.taylor@danwood.co.uk>", "Subject:      FW:      Branch      Administrator  
  Training", "Date: Mon 19Jul 1999 11:34:00 +0100"
```

- The file is to contain email sender, email recipient, email subject and the date it was sent (in the above format).
- A new file is to be created every day, containing the captured information. The date of that day used is to be used as the filename.
- If the application cannot read a mailbag it is to store the details of which mailbag it could not read and copy it to a separate folder for manual processing.
- The applications do not require a graphical user interface and should run on Windows 95 or higher.



## Appendix 7

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### Specification for the POP3 Mail Application



**POP3 Mail Collection**

To develop an application that can store the information gained from polling the employees’ email accounts on the SLMail server into a database for easier manipulation. The application is to access the SLMail server directly using POP3 commands, which will avoid file locking and reduce the amount of emails that might be missed through copying files.

**Specification**

- The application is to use an Access database.
- Two tables are to be created in the database. The first table is to contain the login details to gain access to each employee email account and the field names to be used are were UserName, Password, FileLastAccessed, MailBoxName, MsgNo. The second tables to be created in the Microsoft Access Database application. The second table is to store information about the type of email in the employees account and the fields to be used are Sender, To, Subject, EmailDay, EmailNum, EmailMnth, EmailYr, TimeOfEmail, EmailType.
- The example below shows the data types that are to be stored in the database. The first three entries into the database are self explanatory, sender of the email, intended recipient and the subject of the email. The next five fields contain information of when the email was sent, the day of the week, the day of the month, the month, year. The remaining two fields contain the time of day and whether the email is business or non-business related.

```
o  suzan.temple@danwood.co.uk,vanessa.snow@danwood.co.uk,Gram  
   pian Uni Hospital SD2275, Wed, 5, Jul, 2000, 12:30:47, b
```
- The final field EmailType is to store either “b” for business or “o” for other, for the type of email message sent. The emails are to be sorted automatically by the POP3 Mail Collection application into either business or other. A function within the application must determine if an email is business or non-business.



- The application must be able to give confirmation that it is still running and also email the database directly to a predetermined email account. If an email is sent and processed by the POP3 Mail Collection application with one of these two as the subject line, “Email Database” or “Up & Running” an email should be sent to the predetermined email address confirming that the application is still running and in the case of “Email Database” subject line, the database should also be attached to the confirmation email.
- The applications do not require a graphical user interface and should run on Windows 95 or higher.



## Appendix 8

### Specification for the Danwood One-Line Email Application



### **Short Message Service Application Overview**

This project complements the research carried out by Tom Jackson who is the main client for this project. The project entails developing a short message service for the Danwood Group.

### **Specifications**

- The short message service should be developed for Outlook 2000.
- Part of Danwood's IT department strategy is to upgrade all users to the latest email client software, which is why the short message service is to be designed for the latest version of Microsoft Outlook.
- The short message service should be easily accessible through Outlook 2000.
- The reason for this objective is to encourage users to use the short message service. If the service is difficult to use then the users would resort to sending traditional emails, and thus defeating the project objectives.
- The short message service is to have the same look and feel to that of Outlook 2000.
- It is imperative that the short message service is seamless and acts as an integral part of Outlook 2000 encouraging use of the short message service.
- The short message service is to be simple to use.
- The major driving force behind this objective is to minimise the amount of training required for the Outlook 2000 users. If the short message service is too difficult to use, then this will inhibited short message use and thwart the project objectives.
- A user manual is to be distributed to all users explaining the functions and intended use of the short message system.



- A user manual is to be created to enable users to refer a document if they have an issue regarding short message use.
- Short messages should be sent to only one intended recipient and not to multiple recipients internally. The reason for this is to help distinguish the difference in functionality between a short message and a traditional email. Users have the option to send to multiple recipients by using a traditional email.
- The recipient of a short message should have the option to reply to the original sender *as a short message*, the reply will be to the original sender and to no other parties.
- When a short message is received the recipient will be notified of the short message in their Inbox, flagged with a different icon.

### Technical Specification

The technical specification discusses the resources that would enable the short message service to function. The following section highlights the main technical specifications

- Outlook 2000 is the email client to be used
- The short message service is to be developed for Outlook 2000 (Version 9.0.0.2711). As previously mentioned in the specification, the reason for using the latest Outlook client was due to Danwood's IT strategy to update the email software.
- SLMail is the email server to be used.
- SLMail Version 3.2 is the email server software that Danwood use for email. This is to form the backbone for delivering short messages.



- Operating Systems – The short message service application must run on the following operating systems:
  - Microsoft Windows 95
  - Microsoft Windows 98
  - Microsoft NT Server 4.0
  - Microsoft NT Workstation 4.0

It is to be assumed that Outlook 2000 has been fully tested on each operating system by Microsoft; however, the short message service application is to be tested during the project-testing phase on all operating systems running Outlook 2000.

### **Distribution and Implementation Considerations**

The short message service application should be distributed in an efficient manner to minimise any disruption to the employee. Installing the short message service requires carefully considered with regards to whether a user would follow instructions from a user manual, or whether the short message service application is installed from a logon script.



## Appendix 9

### Review of Email Monitoring Software



### **I-SPY**

Visionsoft's I-Spy is a comprehensive data-logging tool for Windows 95 PCs. I-Spy consists of two main parts - the Control Centre, and the I-Spy Sentinel. I-Spy allows you to record every action the user takes. It also allows for the creation of a list of events that when occur can be reacted to. I-Spy can be configured to watch for the user typing specified words and react to it as soon as it occurs. The Control Centre allows the logging set-up to be designed and implemented. Groups, users, and logging templates can be designed, created, altered and applied from the Control Centre and all returned logged data is viewed from the Control Centre. I-Spy Sentinel performs the logging and it uses the logging templates, the keywords and triggers to monitor the actions of each user. Until a keyword or event is triggered, it runs silently in the background of each user's computer. It is usually installed from the network login script (Visionsoft 2000).

The author trialed the software at the Danwood Group on four employees and although the software was excellent for data logging, its ability to work in the background without causing too much disruption to the employee was its downfall. On start-up of the computer, the employee is warned about being monitored and a pair of I-Spy eyes are added to the system tray as shown in Figure 1.



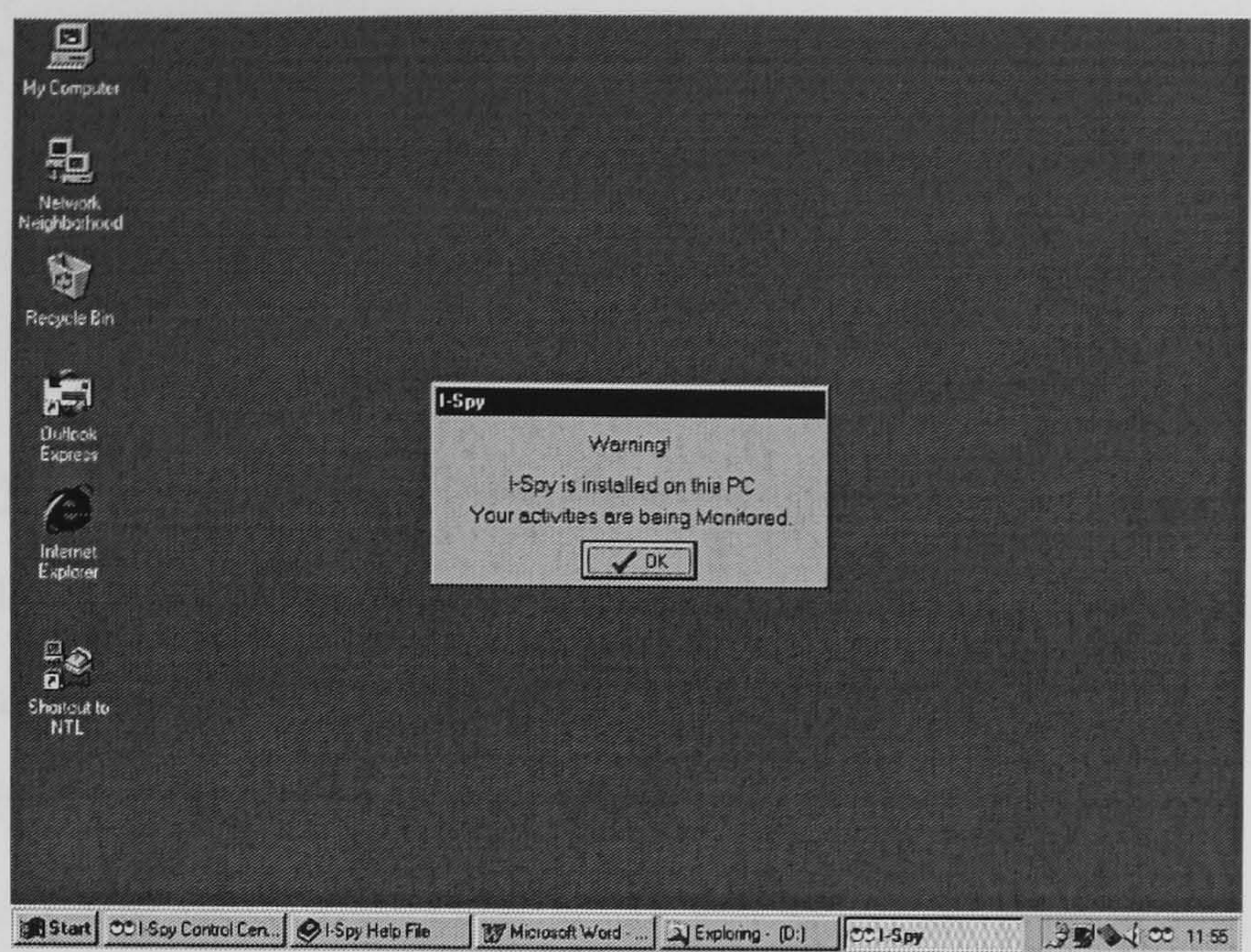


Figure 1 – The initial pop-up box for I-Spy

The program caused complaints from each employee in the study and whilst watching their computer screens remotely, they all tried to remove the software from their computer causing maximum disruption to their intended work. For this reason the software was not chosen for the next monitoring phase.

**Windows Ranger**

Sentinel’s Windows Ranger is a powerful management tool that not only allows monitoring of users but also restricts their access to predetermined areas and applications. For example, you can restrict the amount of time individuals or groups are allowed on a given application. Similarly, if they exceed a predetermined quota of disc space, Windows Ranger will highlight the files in use. Users can then choose for themselves which ones can be deleted - cutting down a huge amount of staff involvement, yet teaching computer skills at the same time. At any time, it is possible to track exactly how the users are using the network (Sentinel 2000).



Windows Ranger was not installed and evaluated at the Danwood Group, but at Leicester College where they had a fully working version in place. The initial results of monitoring users' email interaction were good but the application was frequently crashing and did not allow enough data to be gathered for a full evaluation. The reliability of the system could have been down to the number of users it had to monitor. Sentinel were sent an invitation by the author to set-up a smaller scale operation at the Danwood Group and become more involved with the research, but the invitation was turned down. With the cost of the application being too expensive to purchase and with the uncertainty over the reliability, the software was not chosen for the next phase of email monitoring.

### **Back Orifice 2000 (BO2K)**

Back Orifice 2000 is a powerful network administration tool available for the Microsoft environment. Built upon the success of Back Orifice released in August 1998, Back Orifice 2000 allows the user to control the system, network, registry, passwords, file system, and processes. BO2K is like many other major file-synchronisation and remote control packages that are on the market as commercial products, except that BO2K is smaller, faster in certain areas, free and extensible. Through the open-source development community BO2K has grown even more powerful and because of how the program has been developed concerns also grew. One of the major concerns regarding the Back Orifice 2000 program is whether or not the program is a secure and legitimate alternative to other commercially available remote administration suites (DilDog 2000).

In the past, Back Orifice has been used as a Trojan horse by hackers to annoy and sometimes harm Internet connected Windows 95 machines. This is a fact of life with a tool that has the ability to be silently installed and can perform administration without end-user intervention. This, however, is not unique to Back Orifice. There are many



Trojan horse programs out there, and many legitimate remote administration tools that have the capability to perform quiet remote installations, should the user download the software and execute it without realising what it is. Carbon Copy 32 from Compaq is a popular competing tool that has this ability.

Vulnerability to Trojan horse programs is an inherent flaw in the Windows architecture, but is by no means unique to it. Software can be executed on a system without any form of user intervention, approval, or feedback. The features of Windows that keep the user from being overwhelmed with information regarding the workings of their computer are the same features that allow Back Orifice 2000 to keep itself hidden from view. Microsoft has ways to keep Trojan horse programs from affecting users, via code signing, but the method is not well accepted, due to the inconvenience on developers.

Though BOK2 is very powerful its reputation precedes it and the Danwood Group were sceptical about breaching their security in monitoring employees. The author did trial the software on a few machines but found it to be slow in some circumstances and unreliable with the software crashing frequently throughout the day. Due to these problems the software was not chosen for the next phase of email monitoring

### **Lotus Screen Cam**

Lotus ScreenCam turns the PC into a VCR (Video Cassette Recorder) that records every click, scroll and action on a PC screen (Lotus 2000). The first problem encountered was the amount of disk space required to record an employee for 8 hours a day. This was dependent upon a number of variables, making it difficult to quantify, for example screen resolution and the amount of user activity. The formula for calculating the disk space required is shown in Figure 2.



$((\text{screen resolution X}) \times (\text{screen resolution Y}) \times (\text{number of screen colours in bits})) \times (\text{frames per second} \times \text{number of seconds})$

Figure 2 - Formula for calculating amount of disk space required.

So, a 640x480 screen at 256 colours (8 bits), computed at 2 frames per second for 15 seconds would equal:  $(640 \times 480 \times 8) \times (2 \times 15) = 9,216,00 \text{ Kbytes}$  or 9.2 megabytes

Not only was the size of the file a problem, but also the reliability of Lotus Screen Cam when monitoring Microsoft applications was low, as the application being monitored frequently crashed unexpectedly. Due to these problems the software was not chosen for the interrupt recovery times research.



## Appendix 10

### Specification for the Email Pickup Times Application



### Email Pickup Times

Create an application that monitors the email server to determine the frequency of employees downloading their email.

### Specifications

- The captured data is to be store in a new file, which is to be created every day with the date of that day used as the filename.
- The application must record the name of the employee and the time the employee downloaded email from the server to their local machine.
- The recorded information must be stored in a comma separated text file with two entries per line (name, time).
- The application does not require a graphical user interface and must run on Windows 95 or higher.



## Appendix 11

### Specification for the Mobile Phone Analysis Application



**Mobile Phone Analysis Specification**

To build an internal billing system for the Danwood Group that creates bills for employees who are spending over their predetermined mobile phone allowance. The application is to compute the disk bill provided by Orange. The disk bill from Orange contains information regarding the mobile phones used by employees at the Danwood Group.

The application works by using a data file called data.txt, which contains information about mobile phone numbers, employee names and the amount of minutes they are allowed to use. The application processes the data.txt file along with the disk bill provided by the mobile phone company to produce individual bills.

**Specification**

- To import the disk bill data supplied by Orange into the Mobile Phone Analysis application.
- The Mobile Phone Analysis application is to store further information about the employees in a file called data.txt. The will contains information about employee mobile phone numbers, employee names and the amount of minutes they are allowed to use.
- The application should produce the following reports on:
  - every employee who is spending other their predetermined allowance.
  - the number of text messages sent, the recipient and the time they were sent.
  - the number of mobile phone calls made between certain times of the day.
- The reports should be outputted to a MS Word document called bills.doc
- The application should work on Windows 95 and above

This is an example report:

```
Date : 01/12/2000

Mobile Number : 7970817911

Name : Surname Firstname

01/12/2000 18:07:02 01522882484 Lincoln 000:01:13 Orange Peak
01/12/2000 18:44:30 01522685681 Birchwood Lincs 000:04:56 Orange Peak
02/12/2000 15:32:21 07930180720 Mercury One2One 000:02:20 Orange Off-Peak
03/12/2000 12:23:22 01522685681 Birchwood Lincs 000:00:43 Orange Off-Peak
03/12/2000 14:12:37 07967400917 Orange 000:00:04 Orange Off-Peak
```



Appendix 11

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03/12/2000	15:31:18	07967400917	Orange	000:02:33	Orange Off-Peak
03/12/2000	15:34:22	01522685681	Birchwood Lincs	000:02:15	Orange Off-Peak
04/12/2000	12:53:07	01529414282	Sleaford Lincs	000:00:25	Orange Peak
05/12/2000	13:00:12	447951128988		000:01:27	Orange Peak
05/12/2000	15:48:27	07930180720	Mercury One2One	000:00:06	Orange Peak
05/12/2000	17:33:51	01529414282	Sleaford Lincs	000:00:43	Orange Peak
07/12/2000	18:06:44	447973100123	Orange Answering Service	000:00:51	Orange Off-Peak
07/12/2000	18:08:34	447973100123	Orange Answering Service	000:01:18	Orange Off-Peak
08/12/2000	14:33:04	07970831826	Orange	000:01:10	Orange Peak
08/12/2000	14:43:28	07970831826	Orange	000:00:54	Orange Peak
08/12/2000	15:23:59	01522882484	Lincoln	000:00:04	Orange Peak
08/12/2000	18:53:19	447973100123	Orange Answering Service	000:00:54	Orange Off-Peak
08/12/2000	18:54:31	447973100123	Orange Answering Service	000:00:32	Orange Off-Peak
08/12/2000	18:55:19	447973100123	Orange Answering Service	000:00:05	Orange Off-Peak
08/12/2000	18:55:30	447973100123	Orange Answering Service	000:00:28	Orange Off-Peak
08/12/2000	19:10:14	447973100123	Orange Answering Service	000:01:07	Orange Off-Peak
09/12/2000	11:11:42	447973100123	Orange Answering Service	000:00:26	Orange Off-Peak
09/12/2000	11:20:06	447973100123	Orange Answering Service	000:00:53	Orange Off-Peak
09/12/2000	11:31:14	01529305940	Sleaford Lincs	000:00:12	Orange Off-Peak
10/12/2000	12:10:11	07930180720	Mercury One2One	000:00:12	Orange Off-Peak
10/12/2000	14:06:49	447973100123	Orange Answering Service	000:01:57	Orange Off-Peak
11/12/2000	22:20:42	447973100123	Orange Answering Service	000:00:27	Orange Off-Peak
13/12/2000	08:08:19	01179159961	Bristol	001:23:09	Orange Peak
14/12/2000	08:35:16	447973100123	Orange Answering Service	000:00:27	Orange Off-Peak
14/12/2000	18:00:53	447973100123	Orange Answering Service	000:00:42	Orange Off-Peak
19/12/2000	12:28:52	01522685681	Birchwood Lincs	000:00:55	Orange Peak
20/12/2000	17:36:08	07899896869	Vodafone Mobile Phone	000:00:40	Orange Peak
21/12/2000	16:08:39	01522685681	Birchwood Lincs	000:01:20	Orange Peak
29/12/2000	15:18:02	07930180720	Mercury One2One	000:00:07	Orange Peak
29/12/2000	15:46:34	07930180720	Mercury One2One	000:02:10	Orange Peak
29/12/2000	21:02:07	01529410278	Sleaford Lincs	000:12:01	Orange Off-Peak
30/12/2000	14:59:04	07967400917	Orange	000:10:43	Orange Off-Peak
30/12/2000	16:24:41	01529413459	Sleaford Lincs	000:00:14	Orange Off-Peak
30/12/2000	17:29:42	01522689709	Birchwood Lincs	000:11:46	Orange Off-Peak
30/12/2000	17:41:56	01529410278	Sleaford Lincs	000:01:51	Orange Off-Peak

Amount of Time used Excluding 0800's : 154.333333333333 minutes

Amount Due : £ 11.32

Number of Text Messages : 0  
Cost of Text Messages @ 3.525 : 0



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