Case Study: Measuring Electronic Communication Defects and their Impact at 3M

Anthony Burgess[1], Thomas Jackson[1], Janet Edwards[1] and Rob Matthews[2]
[1]Loughborough University, Leicestershire, UK
[2]3M UK Plc, Bracknell, UK
a.k.burgess@lboro.ac.uk, t.w.jackson@lboro.ac.uk, j.edwards@lboro.ac.uk

Abstract

Although email is frequently often thought of as a quick and efficient form of communication, often little thought is given to how email affects the employee. This paper has made steps towards gaining a better understanding of email communication and how it can be used more effectively in an organisation. The results obtained from this study can also provide the basis for communication usage policies and training, which could then reduce wasted time and improve employee productivity. It has also shown both the value of obtaining metrics and the difficulties involved. The paper highlights some of the problems, and some of the issues that need to be addressed with email communication within a large organisation.

1 Introduction

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 that people do, even small improvements in the effectiveness and cost of the communication processes can have significant benefits [1].

As new communication methods are introduced into organisations it is important to understand how and why the new media is used [2], as it is not the media per se

that determines communication patterns, but rather the social processes surrounding media use [3]. Organisations are now becoming aware of some of the problems that are associated with these new methods. Email is often thought of as a quick efficient means of communicating with other people, although the volume of emails can have a detrimental effect on employee productivity, as well as the network infrastructure of a company. In an attempt to reduce the amount of email traffic British Airways launched the 'daily email' with the clever headline 'Thousands buried in e-quake'. Email has become one of the top ten stresses of working life, and this also comes from the belief that emails need to be responded to immediately [4].

The company 3M have become increasingly aware of the problems that were associated with electronic forms of communication such as email, not just in the volume of messages that were transmitted throughout the company, but also with how ineffective this form of communication could become. 3M commissioned the authors to undertake research into their email communication at all of 3M's UK sites. This paper reports the research that was undertaken at 3M and shows how to measure the impact of email within organisations, and suggests ways of improving some of the problems that it brings.

2 The Cost of Email Interruption

Earlier research was carried out into how employees used email at the Danwood Group at Lincoln in the UK. This research was part of a wider research programme to identify the costs and benefits of the Information Technology (IT) within the company. The aim of this research was to measure the cost of an email interrupt.

In this case employees were monitored on how they used email. The effects of how monitoring individuals can influence the outcome of an experiment are well known since the Hawthorne studies in the 1920's. The Hawthorne studies found that employees' productivity increased whenever they were in the presence of a researcher who was observing them [5]. This was later coined as the 'Hawthorne Effect'.

It was important that the employees were not aware of the fact that they were being monitored, otherwise this could affect the way they work and operate, and thus lead to results that fail to give an accurate indication of how the employees interact with email. Various methods could have been used to monitor employees while they worked. The most obvious way was to record the employees at their desks, while they were carrying out various activities and capture this using a video camera. This method was deemed inappropriate by the board or directors. Another option was to physically monitor employees at their desk, although this was thought inappropriate and would probably produce distorted results due the Hawthorne effect [5]. The chosen method of observation involved using a piece of software that enables the user to remotely view an employee's monitor screen from their own screen. There were no ethical problems with this because all employees

had signed an agreement when they joined the company regarding the monitoring of staff using computers.

Using a piece of software called WinVNC, 15 employees were monitored over a 28 day period. The output from this was recorded onto videotape which led to over 180 hours of videotape recordings. All the employees email interaction was recorded, including how employees reacted to interrupts, and the time it took to return to work after the interrupt. The definition of an email interrupt is any email distraction that makes an employee stop their planned activity, and the recovery time was calculated by the amount of time that it took an employee to return to their work at the same rate at which they left it [6].

The research has shown that the time it takes employees to recover from an email interrupt, and to return to their work at the same rate at which they left it, was found to be on average 64 seconds [6]. It was also found that it took the average employee an average of 1 minute 44 seconds to react to a new email notification by opening the email application, although 70% of emails were reacted to in 6 seconds of them arriving. All of the employees being monitored had some form of notification on the desktop when they received new email.

Knowing how employees are interrupted is useful when trying to cost the time that it takes employees to recover from an email interrupt. Employees can become more efficient if they are interrupted less frequently. This can be achieved by increasing the time intervals that the application checks for new mail on the server.

3 Evaluating Email Communication

Jackson's earlier research [6] shows how employees are affected by email interruptions and how employees use email, which is useful when trying to put a cost value on the amount of time that is spent using email. However, Jackson's research falls short of qualitative aspects of email use. In an attempt to gain qualitative aspects of email use a web based questionnaire was designed, that would be used to determine how employees evaluated email use within the company. This questionnaire was aimed at the whole company (3M UK Plc), and was rolled out in December 2002. 3M UK is a large organisation who employee over 3000 people in the UK at over 12 offices. 3M is a diversified technology company with manufacturing as well as sales and marketing operations, and the questionnaire was aimed at all email users in all departments.

The questionnaire focused on the quantitative aspect of email as well as the qualitative side of email use. For the former, the authors were interested in the average numbers of emails that employees received each day, and how they viewed their importance. Respondents were asked not only how many emails they received on average each day, but also how many were purely for information purposes, and how many they had been copied in on unnecessarily. From these questions what proportion of the emails employees receive were actionable and

what proportion were classed as irrelevant was calculated. This information would be most useful to 3M because it would identify areas of potential problems. The qualitative aspect of the questionnaire aimed to find out how employees evaluated the emails they write and receive. It also aimed to discover their views about email use within the company.

The questionnaire was also used as a baseline to try and establish the current state of email communication within the company. The finding would then be used to develop further investigations into potential problem 'hotspots' within the company.

4 Capturing the Data

The initial study at 3M was conducted with the aim of creating an overall picture of the current state of electronic communication within the company. This would then be used to help improve the effectiveness of electronic communication within the company by changing some of the ways that email is used, and by training employees in the appropriate areas. The main focus of electronic communication was initially email use. By aiming for a broad picture of the current state of email use within 3M, it meant that the study had to cover a range of issues that could be associated with email use within a company.

3M were concerned about what proportions of an employee's email were regarded as important. A significant proportion was thought to be irrelevant or not significant. It was important to capture this information, especially if employees were spending time reading emails that were not directly aimed at them, or not relevant to them. In order to capture this information employees were asked to specify how many emails on average they receive each day, and how many were for information purposes only, how many were irrelevant, and how many were untargeted. The employees were also asked to specify how many emails they received that were either difficult to understand, or that they found the purpose of the message unclear.

Employees were asked to rate the emails they wrote and received according to how well written they were, and whether they were to the point. This was important because it was felt that some emails were ambiguous, or the purpose of the message was unclear. It was important to know if employees were spending too much time reading emails that were badly worded. The aim of this was to also gain an insight into how efficient the employees thought the emails they sent and received were. Employees answered questions by circling a number on a scale, after being asked to what extent they agree or disagree with a statement.

The authors were keen to investigate employees' views on email training. Employees were asked if they were familiar with the functions of their email application, and if they felt that they needed training on the best practices of email use. They were also asked for their evaluation of a hints and tips document that had

been sent out to employees prior to the investigation. This was a set of guidelines designed to help employees write more effective emails. The aim of this set of questions was to find out if the employees felt that they needed training on any aspect of email use.

When looking at the employees' use of email, it was felt useful to investigate whether employees felt that email is used too often when another form of communication would be more appropriate. For instance did employees feel that email is used too often, when a phone call or face to face conversation would have been more appropriate. Capturing this information would give 3M an indication of how effective email use is within the company. If it was found that email is too often used when it is more appropriate to use another forms of communication then the company could introduce measures to rectify this.

The questionnaire also asks employees to specify their department, location, and other characteristics of their job so that comparisons can be drawn between different sets of employees. Many of the questions were closed, and employees were required to choose an answer. Five of the questions required the respondents to enter a value, and one question was used to ask employees if they had any comments about how email was used within the company.

It was decided that the best way to capture the information required would be to use a questionnaire. This is because the study was aimed at the whole company with over 3000 employees, and a one to one interview approach with all the employees would be impractical due to time restrictions. It would also be impractical to monitor such a large number of employees to get the information required. The questionnaire was hosted on the Internet, this made capturing the data easier than if a paper based questionnaire had been used. Each response to the questionnaire was automatically stored in a database, with each column representing each question, and each row representing each submitted response. The questionnaire was hosted at Loughborough University, and not at 3M. This way it was possible to ensure that the data would not be manipulated prior to analysis.

When developing a web based questionnaire there are many issues that need to be considered. The technical issues included ensuring that the web site was secure, and could not be interfered with by a third party. This was important because the authors did not want anyone to be able to access the questionnaire and submit bogus responses. There were also concerns over the use of a proxy server at the company, as this means older out of date copies of web pages can still be on the proxy even if it has been updated at the original source. To resolve this issue a different new URL (Universal Resource Locator) was used when the questionnaire was ready to go live. This URL had not been used for anything prior to the final live version of the questionnaire. This meant that there would have been no old versions of the questionnaire using that URL on the proxy. The proxy also has to be taken into consideration when the questionnaire is to be finished. If there are copies of the questionnaire on the company proxy then even if it is taken down

from where it was originally hosted, employees may still be able to submit responses. In this case as soon as the questionnaire was ended, the passwords for the mySQL database were changed, so that even if employees could still access the questionnaire, responses would not be sent to the database, because the password would be invalid. The final consideration was the host machine at Loughborough University. A machine was selected and tested to determine if it could cope with the amount of bandwidth that was required to host a questionnaire taking into consideration the amount of hits it was likely to receive at one time.

5 The Current Impact of Electronic Communication at 3M

From the questionnaire that was carried out at 3M it was discovered that the average number of emails received each day by an employee was 23. On average 41% of the emails received are for information purposes, and on average employees believe that they are copied in unnecessarily on 16% of the emails they receive. Employees believe on average that 13% of the emails they receive are irrelevant or untargeted.

This would indicate that employees spend a considerable amount of time reading emails that are not helping them do their job. If these unproductive emails were all from internal sources then the company may have to introduce guidelines on how employees can better target their emails. This information is not obtainable from the results because the questions did not ask the employees to specify what proportion of their email comes from outside the company.

In general 3M employees think that they write good emails. 89% of respondents indicated a positive response when asked if they write easy to read emails. Only 1% of respondents gave a negative response, and 10% were neutral. If these results are compared to how employees evaluate the emails they receive in terms of whether they are easy to read, then we can see a different viewpoint as shown in Figure 1.

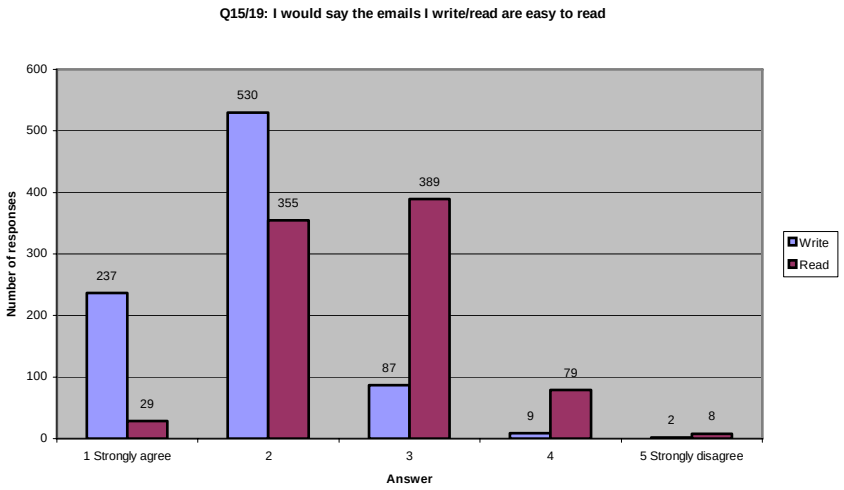

Figure 1 - Employees evaluation of easy to read / good at writing emails

When asked if the emails they receive are easy to read 45% of respondents gave a positive answer, while 10% gave a negative response and 45% were neutral. This shift in opinion between evaluating the emails employees write and those they receive is similar in other questions where employees are asked to evaluate different aspects of the emails they write and receive. This is shown in table 1.

Question	Write			Read		
	+VE	Neutral	-VE	+VE	Neutral	-VE
I would say the emails I write / read are easy to read	89%	10%	1%	45%	45%	10%
I would say the emails I write / read are straight to the point	84%	14%	2%	33%	50%	18%
If I write / read an email that requires action it tells the recipient / me what is expected of them / me	84%	13%	3%	46%	39%	15%
If I write / read an email that requires action it states when action is required	67%	23%	8%	37%	40%	23%

Table 1 - How employees evaluate the emails they read and write

Table 1 indicates that employees rate the quality of the emails they write, yet it appears that they do not rate as highly the emails they receive. This maybe because it is their own emails they are evaluating for the ones they write, not someone else's. Whereas when the employees are evaluating the emails they receive, they are not evaluating something they have written. This may be due to differences in how employees evaluate themselves and their peers.

Only 46% of employees said that the actionable emails they receive state what action is expected of them. On average 8% of the emails received each day are either difficult to understand, or employees found the purpose of the message unclear. If employees do not understand a particular message then this can lead to a delay in an action being carried out. Emails of this nature can also cause the recipient to misinterpret the message, which can have disastrous implications for the company. This would be especially problematic in areas where the detail of a message is of crucial importance, such as software development. It is also important that emails are to the point. If the message is complex then it may be more appropriate to speak in person, not only to save on the time writing the email, but also to reduce the risk of the message being misinterpreted.

37% of employees said that when they receive an actionable email it does say when action is required. This would indicate that some actions may not be completed when expected because the recipient was unaware of any deadline. This can be of vital importance in areas where a client may be waiting for delivery of a custom piece of machinery or software. It is unclear to what extent the lack of deadlines in a large proportion of actionable emails contributes to the reason why many software projects fall behind schedule. This is an area for further investigation, although it is likely to be due to other socio-technical issues as well.

At 3M only 37% of employees said that they have pop-up notification when they received new email. Although if this is compared to how employees responded when asked if email distracts them from other work, it can be seen that there is no correlation between whether employees have pop up notification or not, and whether they think that email does distract them from other work. This is shown in Figure 2.

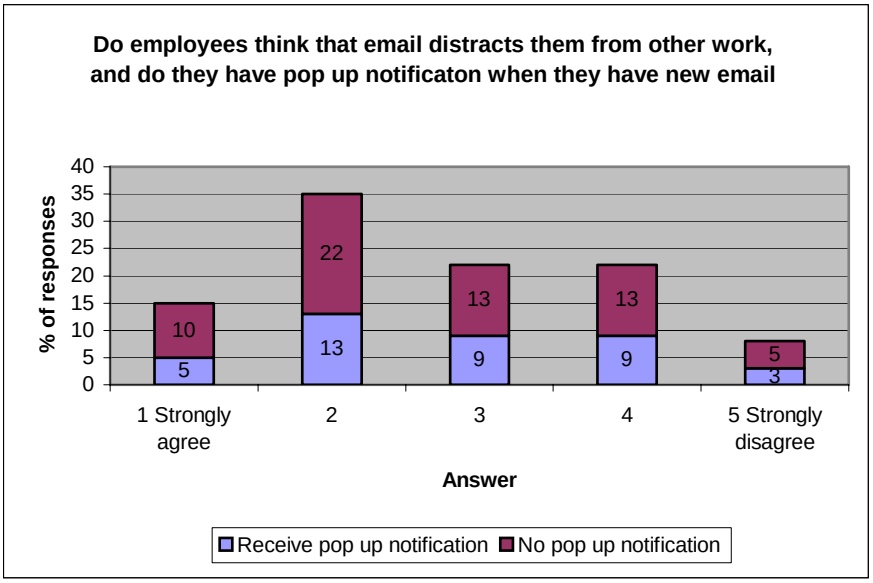

Figure 2 - Pop-up notification versus email distraction

When the employees were asked if they would benefit from training on the best practices of email use, only 32% of respondents gave a positive answer. 39% of respondents gave a negative answer, while 28% were neutral. When asked about if they understood most of the functions of their email application 68% of respondents indicated a positive answer, 9% indicated a negative response, and 24% were neutral. This indicates that the majority of employees at 3M do not feel that they need training on the best practices of email. This is reflected in how the majority of employees believe they know how to use most of the functions within their email application. Although training on the best practices of email would cover more than just the functionality of an email application. It maybe employees were unsure of what the training would involve.

When 'hints and tips' were issued to employees 41% of respondents agreed that they were useful, 18% gave a negative response and 27% were neutral. 14% of respondents admitted to not receiving or reading the hints and tips. The hints and tips contained simple advice on how employees could better manage their use of email. Many may have thought the comments to be 'common sense', and that may be why many employees do not think they need training. Of the people who didn't read the hints and tips 38% of them agreed that they would benefit from training, 37% disagreed, and 24% were not sure.

Many of the comments received regarding email use within the company mentioned how email was being used more and more instead of other forms of communication. 56% of respondents agreed that email is too often used when face

to face communication or the phone should be used instead. 19% disagreed with the statement and 25% were neutral. This would have a massive impact on the amount of unnecessary email traffic that was generated by an organisation. Time would also be wasted writing and reading emails that contain information that would have been more effectively communicated by another medium.

The other significant comments made were regarding the ways that employees receive un-targeted email. Many complained about the over use of the 'reply to all' function, or the inaccuracy of mailing lists. This would again increase network traffic and increase the time employees spend reading irrelevant or untargeted emails. This was also observed in the earlier study at the Danwood Group [6]. Comments were also made about how to assess the importance of emails. One of the recommendations made to the Danwood Group involved making the first few lines of every email visible without opening the email itself. This would allow employees to assess the importance of an email without opening it. This is assuming that the visible few lines contain sufficient information for the employee to assess its importance. Employees at 3M were asked if the subject line of an email contained sufficient information for them to be able to assess the importance of the email. Only 27% of gave a positive response to this, 45% gave a negative response, and 28% were neutral.

Despite the comments made by employees, and the proportion of non important emails received, 60% of respondents were happy with the way that 3M employees used email. 12% were unhappy and 28% were neutral.

6 Conclusion and Further Research

While the results are not yet complete the study has already increased the understanding of email communication within the organisation. The analysis has also been a useful learning exercise for the company. It has shown both the value of obtaining metrics and the difficulties involved. The paper has highlighted some of the problems, and some of the issues that need to be addressed. The main areas are:

- The quality of the email message needs to be improved, as 37% of the emails do not leave the recipient with enough information to undertake a specified task. This could be problematic if the recipient tries to interpret the sender's message and could lead to a high level of inefficiency.

- There needs to be a reduction in the number of untargeted information emails sent. This can be achieved through applying Jackson's guidelines of restricting the use of email-to-all messages, and in particular reply-to-all messages, as well as introducing the use of more targeted email user groups [1].

- Further research is required into training delivered through email as 41% of the employees agreed that the ‘hints and tips’ about email were useful and only 14% of respondents admitted to not receiving or reading the hints and tips.

- Further research is also required into how employees value a good email. As the majority of employees consider themselves to write good emails, yet they do not receive good emails.

This paper has made steps towards a better understanding of email communication and how it can be improved. The results obtained from this study can also provide the basis for communication usage policies and education, which could then reduce wasted time and improve employee productivity.

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