Strategies to reduce Email Overload

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Abstract. Over the last 30 years email has developed from a simple asynchronous communications medium to an omnipresent application covering a range of information management functions. Concurrent with the growth in the volume of email messages has been the emergence of a significant body of literature of best practice use of email. Central to this literature has been a focus on the role email plays in the phenomenon of 'information overload' and that this 'email overload' leads to stress and a reduction in productivity in the email recipient. Popular literature points to three core methodologies to counter this phenomenon, firstly reducing the frequency of interruption by turning off notification and only checking messages at certain times is proposed to lessen the negative impacts of constant interruptions. Secondly messages should be filtered on arrival in order to prioritize response and, finally, messages should be filed logically in a structured folder format to ease later retrieval. This paper looks at the research into these three techniques to assess the validity of the claims that they will reduce email overload. Due to a shortage of research specifically on 'email overload' the much larger body of literature on 'information overload' is reviewed and inferences made that are applicable to email. The conclusion drawn is that, with the exception of filtering, there is little clear evidence that any of these three methodologies can significantly reduce email overload. Furthermore the research is contradictory and in many cases the techniques may actually lead to or increase in email related stress and/or reduction productivity.

Keyword: email overload, managing email

1. Introduction

Email allows users to communicate at little or no cost to vast numbers of geographically remote colleagues [1]. Despite these manifest benefits there is often antipathy toward email with it cited as the prime cause of 'overload' in the work environment [2, 3]. Users complain of the sheer number of emails that they are forced to cope [4] with and the frequency with which these messages interrupt their normal work. Researchers decry the tyranny of email [1] pointing out that the control of exposure to new information is in the hands of the sender not the receiver [5]. In addition, Bellotti, Ducheneaut, Howard, Smith, and Grinter (2005) suggest that the complexity of the message or task may contribute more to overload than the volume of messages received. Furthermore, the email client has evolved to become more than a simple communications interface; users have applied it to a variety of personal information management functions. As well as emails, the user's inbox has become the repository for current and pending tasks ranging from the simple to the very complex, from the mundane or unnecessary to the strategically vital of the tactically urgent. All this is placing increased strain on users to manage their information leading to what is often referred to as 'email overload'[1, 6-9].

While there is compelling evidence for the existence of email overload and that it is a significant problem in the work place there is surprisingly little direct research into it [for further information on this see 10]. Equally there is little research into effective techniques users can or should employ to mitigate these issues [11]. This is particularly surprising as email proliferation is often seen as the primary cause of 'information overload' in the workplace and "generally appears high in users' perceptions of the causes of overload" [2]. Furthermore, the terms 'email overload'

and 'information overload' are often used interchangeably reflecting the significance of the contribution of email as a primary cause of overload in general.

Information overload pre dates email overload by several decades with mention of it as early as 1950 and warnings of the dangers of increasing communication load discussed through the 1960's [4]. A number of surveys in the 1980s and 90s point to information overload as a serious issue causing a reduction in work performance and damage to health [2]. Information overload has been researched in a number of diverse fields of study including organization science, marketing, accounting and management information systems and there has emerged consensus that heavy information loading can have strongly negative impact on performance [12]. Research also suggests advances in computer technology including email and the World Wide Web have contributed greatly to an increase in actual and perceived overload [4]. An early definition of information overload asserts that it occurs when "information presented at a rate too fast for a person to process" [Sheriden, T.B., and Ferrell, W.R. 1974 cited in 5]. While this definition is helpful, focusing purely on speed of presentation is too simplistic - the volume and complexity of the emails are also important, as is the fact that email is used for a variety of other functions such as task and project management both of which have been shown to increase overload [5, 8].

Bawden et al. [2] suggest that "information overload occurs when information received becomes a hindrance rather than a help when the information is potentially useful" (p249). This indicates that it is the nature of the information itself that is at issue, but this definition is problematic in the present context as you can only know it is a hindrance after you have received it! In other words you cannot predict a point of overload until you have actually reached it. A more useful definition is that information overload occurs when "information processing requirements are greater than information processing capacities. In this definition the factors 'requirements' and 'capacities' can be measured in terms of available time." [12]. This definition can be easily adapted to define email overload as occurring when 'email processing requirements are greater than email processing capacities.' Again requirements and capacities can be measured in terms of available time. This definition accounts for the volume, speed and complexity of emails as these would all increase email processing requirements. It also allows for the supposed effect of interruptions as the time required to perform the primary task will reduce the capacity available to manage emails.

2. Email overload coping techniques

Early prescriptions for dealing with overload were based around individual time management and user training in what was described as 'information literacy'[4, 12]. This, vaguely defined concept seems little more than the suggestion that users need to be specific about what information they need, why they want it and where to find it. This is unhelpful as, by the nature of email, the information finds the user rather than the other way around and its utility cannot be evaluated until it is read. Often researchers have encouraged organizations to "give employees the right tools so that they can improve their time … and information management" [12] without benefit of definition of what precisely the right tools are.

In their review of the literature (including the popular literature) Edmunds & Morris [4] suggest that coping techniques can be categorized as filtering and filing. Alternative research has focused on the cost to the recipient of constantly monitoring incoming mail, a cost borne by the receiver but instigated by the sender [1]. To mitigate this cost users are encouraged remove notification of email and not to respond immediately but rather at a time convenient to the receiver [13]. In this view, interruptions are inherently negative as they take the worker off the main task impacting productivity. Once the interruption is dealt with there is still impact as the user must readjust him or her self back to the same mental state he/she was in prior to the interruption [1, 14]. In summary there are three popular coping techniques proposed to mitigate the impacts of email overload are: 1/ Filtering incoming messages to discard the un necessary and prioritize the important; 2/ Filing messages in a structured folder system to speed storage and assist with later retrieval; 3/ Managing interruptions by turning off message notification and checking messages at recipient determined intervals. The remaining sections of this paper reviews the relevant research to investigate whether there is empirical support for the claimed efficacy of each of these coping techniques.

3. 1/ Filtering'

In an early work Hiltz and Turoff [5] suggest that overload is an inevitable consequence of the use of electronic communications media, and to cope users need to develop screening techniques. When faced with an influx of messages an obvious response is to attempt to filter out the most important items for action and to screen out the 'electronic junk' [15]. The use of filters seems to be an innate human response to coping with information overload with users shown to naturally filter or omit information as overload begins to occur [16]. Filtering is a technique to reduce overload but in order for users to filter incoming email some form of cognitive effort is required to decide if the information is of value or not. Omitting information may be a quick solution but it is also a dangerous one as the consequences of omission of important information could be severe. Users may omit valuable information simply due to overload but equally because it is difficult or unpleasant to digest even though it may be highly relevant to the tasks to be completed [4].

Research has shown that as overload increases, filtering strategies change and decisions are made based on previously learned responses or users invoke the same response repeatedly [17]. Users fall back onto pre existing practices to process information and further have been shown to be willing to sacrifice quality of decision in exchange for lower cognitive effort (Miller 1978, cited in [17]. The implication is that if filtering is to be an effective strategy,

something other than the email recipient must do the filtering. Furthermore, being electronically based, email lends itself well to automating the filtering process not only to remove unwanted information but to prioritize the useful messages for further action [15].

Spam filters that are designed to identify and eliminate unwanted and unsolicited electronic messages while allowing normal useful mail to proceed are a prime example of such an automated filtering system. The challenge is to avoid errors in the filtering process. An inefficient filter may allow copious quantities of 'junk' messages through and thus be of marginal use. However, potentially more damaging, an inaccurate filter may result in a 'false positive' classifying an important message as junk and consigning it to destruction or 'quarantine'. [18] assessed the efficacy of three generic types of filtering - counter measure list based filtering, content scanning, and forged-e-mail detection. Their results showed that, even when using all three detection mechanisms sequentially they were unable to totally eliminate 'false positives'. While users may accept a filter that lets through a small amount of spam they are much less likely to tolerate a filter that removes useful and important information incorrectly [19].

Much past and present research is focused on the best methodologies and algorithms to achieve intelligent filtering and much email research has moved from cognitive, behavioral and ergonomic design of systems to artificial intelligence studies to make smarter filters [20]. To many the answer lies in the development of ever more sophisticated "intelligent agents" and the field of Artificial Intelligence has become an increasing field for research but the overriding concern of users is that important information will be lost cannot be over come easily. Historically intelligent filtering agents have been developed in two ways which can be characterized as 'user based' or 'knowledge based' [21].

In the former a collaborative approach between person and machine is invoked were the user defines rules based on his/her cognitive criteria for the computer to carry out. However he/she needs to be aware that filtering is needed in the first place, how that filtering should occur and then instruct the agent to carry it out and update them as required over time [21]. While this may be a sizable load on the user it does address the issue of trust as the user is directly involved in discerning the correct rules for filtering [21]. The second approach is a 'knowledge based' design where the computer is endowed with knowledge about the user's goals and the context of work (the domain). Artificial intelligence algorithms are then used to allow the computer to correctly manipulate information within the domain to achieve user goals. The biggest criticism of this approach is the potentially vast amount of knowledge that the designer needs both of the user and of his/her email environment [21]. This makes customizing agents to users problematic as it is unlikely that the developer would have sufficient in depth knowledge of the user's domain to fully instruct the agent. Furthermore this approach takes all control away from the user – something research suggests users are reluctant to tolerate [11].

A suggested alternative model, is that of the 'learning agent' [21] or 'adaptive agent' [22]. Here the agent is given rudimentary information regarding the user goals and the environment and then learns appropriate behavior by observing user activity. Eventually, with sufficient practice the agent can develop the ability to predict user actions and perform them automatically on their behalf. This approach however assumes that the activities being learned include a large amount of repetitive tasks - which seems unlikely given the complexity of email usage [10].

Others suggest that increasing the intelligence of the agents is dangerous and counter productive pointing out that it is not possible to endow an agent with all the necessary cognitive skills and data required to correctly filter in all circumstances [22, 23]. As mentioned, users themselves show reluctance to completely trust automated systems [11]. There are also legal and practical issues to be considered. Intelligent agents typically need to collaborate with each other to increase information regarding their user, tasks and the environment which raises privacy issues, especially when we are considering email [21]. Additionally who is legally responsible for an agent error since as agents become more intelligent and make decisions on behalf of users, users seem to be more willing to blame agents for errors [24]. Furthermore, there is evidence that even if filtering reduces effort this does not necessarily lead to better quality results, in fact it seems users "attend more to effort reduction than to accuracy maximization" [25].

In summary, much research has been carried out on the most effective forms of filtering mechanism but scant consideration has been given to the question of what happens to the messages once they have been filtered. If the filter is effective the highest priorities will be dealt with first but the overall volume of email and the complexity of their content are not addressed by filtering and hence overload may not have been reduced. The only way filtering can reduce email overload is if some of the messages are not processed by the recipient. This inevitably entails some risk as the opportunity of false positives cannot be fully eliminated. Experience with spam filtering shows some level of risk needs to be accepted but it is unclear how filtering of more complicated messages based on content and the work context will reduce overload. It is suggested that, rather than reducing overload, filtering systems should be implemented to aid in prioritizing action on emails rather than attempting to screen messages. Finally, sophisticated filtering mechanisms are not commercially available to most users and even if they were there are privacy and legal impediments to their implementation.

4. 2/ Filing

In order to cope with the volume of received email and to facilitate its future retrieval users are encouraged to establish electronic storage systems to file messages for later review or for archiving [26]. This process is potentially important as email has developed as a task and project management tool [8, 27]. The attractiveness of an orderly filing system to store the copious email users receive is obvious, less apparent are the practical problems associated with this filing. The initiation problem is deciding when the storing should take place, before or after reading? Attempting to

store messages without reading them is both problematic (how do you know where to store them if you don't know their content) and dangerous as vital information may be lost in the depths of the virtual filing cabinet. On the other hand reading the messages before storing them has no obvious positive impact on reducing overload, in fact it may well increase it by adding yet another step to the process. Furthermore, decisions need to be made regarding the structure of the filing system and there can be variations in both format and later retrieval requirements between users and organizations [9, 28]. Additionally, perhaps it would be best to simply rely on sophisticated search engines rather than manually sifting through a potentially vast (albeit structured) array of old emails [29]?

While it is natural to assign the metaphor of the filing cabinet or the desk to help describe the ways that users file electronically there are significant differences. People use physical and spatial clues to identify the contents on their desks and drawers, options not available in an electronic format. Similarly electronic folders require names and, unlike piles of paper on a physical desk, electronic filing systems allow for sub folders [30]. To complicate matters users must remember folder names and the significance these have for categorizing the material in them, unfortunately users often forget [9, 28]. Finally, folders have a single name but the information in an email message may be relevant to a number of different topics or projects [30]. As can be seen the process of filing information is not trivial and the cognitive effort required to design, maintain and effectively use a complex filing system could conceivably "simply replace a message overload problem with a folder overload one." [31]. Forsyth & Chen [32] found that, for some individuals at least, not having a filing system led to high levels of perception of control of time which could be taken as a proxy for lower levels of perceived overload.

In much the same way that individuals structure their paper filing systems users manage their electronic filing systems in a variety of ways. These strategies have been defined as frequent filing, non filing and spring cleaning [9]. This indicates that designing the perfect system for all users may not be feasible as individuals adapt what they are given to suit their own personal habits [30]. Filing is a very personal activity and folder structures reflect an individual's knowledge and understanding of their content as well as personal usage and retrieval patterns. However, allowing users to define their own structures does not necessarily mean they find them easy to navigate later. Mackenzie [28] found that the primary retrieval tool for data is memory so even when users are able to define their own structures, the vagaries of the human mind mean users often forget and are unable to find the information that they are seeking or may even be unaware that it exists [30]. Other research shows that that few users employ elaborate filing systems and those that do soon abandon them as being too difficult to maintain [11, 32]. The conclusion is that there is no one correct way for a user to file any given set of messages. Messages may relate to a number of tasks, projects or topics and could logically be classified by any one of these depending on the preferences and priorities of the filer. These preferences and priorities not only vary by individual but change over time [30], suggesting that "creating a single, static folder structure [may be] infeasible." [31].

However, at a corporate level there are commercial and legal requirements necessitating the maintenance of data storage and retrieval that restricts flexibility of multiple individual storage and retrieval schemas [28]. There exists, then, a conflict between the individual tendency toward unstructured personal filing and the corporate need for effective storage and retrieval standards [28]. As with filtering, the solution has been seen in applying computer technology. [16, 31] developed an intelligent agent which aims to reduce the cognitive burden of establishing the filing structure - an intelligent agent automatically files messages in "clusters" or groups based on a number of attributes, such as, date, sender, recipient etc. Users are required to assign a weighting to the attributes which help to define the clusters that messages were put into and new messages are routed to the appropriate folder by an intelligent agent. Clustering algorithms are used to compare textual similarities between messages and these results used to update the filing scheme. It is contended that clustering based on multiple attributes should make later retrieval simpler than that based on a single attribute.

However, although their results showed clustering significantly improved users' ability to find information over that in a simple ordered list, user defined weighting provide no significant additional effects [16]. The fact that a structured system allowed users to find messages more easily than a simple ordered list is unsurprising, however, the fact that a weighted structure was no more effective than an un-weighted one may reflect the fact that there is no one best way to structure the filing system and users make do with what is given. This would indicate that the investment in an intelligent filing agent is unnecessary, a structure could be developed based on business needs and common sense that may be as just effective as a complex and expensive intelligent filing agent. Additionally, in their experiment Schuff et al. [16] defined success as "users' ability to correctly locate e-mail messages containing desired information" (p1355). But this assumes that the user knew that there was a need to look. While assisting in later retrieval the clustering of emails offers no benefit in terms of prioritizing the reading of emails or of even being aware that new ones exist. Users utilize their inbox as a means of managing pending tasks, incoming emails are a call to action requiring some form of cognitive response [8, 27]. In such a scenario an automatically filed message is a lost task, while this would no doubt reduce workload it would also reduce work effectiveness and is likely to increase stress in the long term.

In summary, individuals show huge variety in their filing structures and it appears the more complex the filing system the less likely users are to be able to maintain it. This is at odds with the commercial and legal requirements of the organization for the storage and later retrieval of business data. Managers need to be aware that users vary significantly in their ability and interest in implementing filing structures and allow for this variation. Even those users who are naturally 'frequent filers' will find difficulty in maintaining complex structured filing systems and to insist on this will only lead to increased stress and a greater feeling of overload with no improvement in productivity. It appears that the best strategy is to allow users to develop their own filing system and to encourage them to keep the structure

simple. Rather than relying on the folder structure itself, easily available search engines should be used to find messages if they in fact are needed later.

5. 3/ Managing Interruptions

Email is often seen as a negative interruption to a user's real work, hence email users are normally advised to take control of timing of these intrusions and make them less frequent [33]. Specifically they are encouraged to disable their message notification and tend to incoming mail at pre planned times that suit the receiver not the sender [1]. Interruptions are seen to degrade productivity by increasing time spent 'off task' and negatively affecting the worker's mental state when it comes to resuming the original task. Researchers point to the time taken for users to resume their original task as evidence of a sharp reduction in productivity caused by the interruption [14].

The link between interruption effect and information overload is based on the supposition that frequent interruptions impact users productivity and ability to cope with the information being presented to them [1]. However Hiltz & Turoff [5] point to the "social cohesion and productivity of information exchange networks that the [email] system fosters" (p.682) as a potential positive in relation to email interruptions. Similarly Thomas et al., [10] view email as "social interaction" (p254) reinforcing the notion that not all interruptions are unwanted or counter productive. Furthermore email interruptions can be seen as simply a 'break' from a mundane task with beneficial effects on productivity and emotional well being [33]. In an experiment where two sets of word processor operators were subjected to differing frequencies of interruptions during their work it was found that as the number of interruptions increased, workers completed the same task in less time without increased error or decreased quality. Likewise research by Jett & George [33] showed that the impacts of email intrusions is not always negative, it can have positive communication consequences providing important information to the worker that can improve his/her performance on the main task or alternatively improve the performance of the intruder in a related endeavor. As a consequence they contend that blanket rules reducing interruptions can have negative implications on overall work performance.

In relation to the potential negative effects of interruptions, the variables researched in this field include the number of interruptions, their frequency, length and complexity as well as the complexity or time criticality of the main task. Zijlstra et al [34] suggest that it is similarities in mental demands between the interruption and the main task that are the most significant factors. Research in the field of 'cognitive interference' suggests that interruptions cause the greatest distraction (i.e., decreases in primary task performance) when they are processed in the same short term memory part of the brain as the main task [33]. In addition, it appears that it is the complexity or time criticality of the main task that is the key issue for interrupt effect rather than the interruption itself. Similarly in their research into Long Term Working Memory theory, Oulasvirta & Saariluoma [35] found that time constraints were the most significant factor in the negative impact of interruptions. Their explanation is that the speed with which subjects were required to operate with meant they did not have time to set the necessary memory markers to allow later retrieval. Reinforcing this, intrusions were found to be most negative and to cause the greatest stress on users is when there are time constraints on the main task [33].

Jackson (2007) investigated the related communication medium of 'instant messaging' usage. In this experiment recovery time after the message interruption was found to be less for instant messaging than that of email. The users attributed this to the absence of junk mail and the fact that messages were from people they knew but would explain a reduction in the number of messages not their time to recover from them. Another potential explanation is that instant messaging has a feature that email lacks – the ability to flag your status as 'busy' or 'available'. This may be critical as it allows recipients to effectively filter messages to only arrive during times when they are not involved in critical or time constrained tasks.

Finally it is worth pointing out that interruption research is focused on the interruption to the primary task with an implicit assumption that this primary task is the most important to be performed and any distraction from it will lead to lower work performance. But it is perfectly reasonable to assume that the interrupting task may well be of higher importance or urgency. In this instance ignoring the interruption will lead to an overall reduction in work performance. The obvious problem is how to know if the interruption is higher priority without being interrupted which leads to consideration of filtering options discussed elsewhere in this paper.

In summary, managers need to be aware of the very real and important social interaction that takes place using email. Allowing these interactions can lead to greater job satisfaction and higher productivity. Others bring important and relevant information enabling workers to carry out their functions more productively. It seems that the key factors contributing to interrupt effect are more dependent on the nature of the main task than the frequency or complexity of the interruptions. This suggests that a blanket ban on notification or a rigid time schedule for message processing is unnecessary and potentially counter productive. The fact that instant messaging users seem to benefit from the ability to flag them selves un-available indicates that users are capable of managing their own status and tools to facilitate this should be incorporated into email systems. Furthermore the assumption that the primary task is more important than that included in an incoming message is far from certain. Additionally there is the possibility that the new email may contain information useful or necessary to the completion of the task in hand. Overall it is suggested that users should be encouraged to avoid email interruption when working on complex or urgent projects but the value of ignoring email at other times is less apparent and can be safely left in the hands of the user.

6. Conclusion

There is evidence that email usage is playing a central role in an increase in perceived 'information overload' and the term 'email overload' has been coined to describe this. Popular literature on email focuses on three main strategies for coping with overload – filtering, filing, and managing interruptions. Despite the perceived size of the email overload issue there is surprisingly little formal research into it. This paper has, therefore, reviewed the literature on the larger topic of 'information overload' to address the question of how effective the three proposed techniques are. Filtering can provide assistance in reducing the volume of received email and spam filters are a prime example of this in action. Filtering however inevitably entails the risk that useful information may be omitted to the detriment of the worker or organization. The alternative is to utilize filters to prioritize messages rather than screening. While this will not reduce overall workload it should improve productivity without the attendant risk of screening, and hence losing, messages that are important. Filing has been shown to be a very personal task with wide individual variation in filing structures. Furthermore the effort required to maintain complex filing structures is beyond the capacity of most users who quickly abandon the attempt. It is suggested that users should be given the tools and freedom to develop their own with general guidelines and instructions to keep the structure simple. The assistance of electronic search engines should be utilized for later retrieval in these simple filing systems. Managing interruptions has been shown to be of value when the primary task is either complicated or time constrained - it is the nature of the task, not the interruption that needs to be considered. While workers should make themselves electronically 'unavailable' while working on difficult of time constrained projects, arbitrary rules as to the frequency or timing checking messages appear to be of little value. Managers should recognise the important social and informational value that email provides in the modern work place and allow workers the freedom to use it in at their own discretion.

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