How can we measure Email Overload?

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Recommended Citation  
Kammerer, Sebastian; Sprenger, Sebastian; Hetzenecker, Jochen; and Amberg, Michael, "How can we measure Email Overload?" (2012). *AMCIS 2012 Proceedings.* 6.  
[http://aisel.aisnet.org/amcis2012/proceedings/AdoptionDiffusionIT/6](http://aisel.aisnet.org/amcis2012/proceedings/AdoptionDiffusionIT/6)

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ABSTRACT

In times of digital information and communication technologies the overload by emails becomes more and more relevant for many employees. To reduce or even avoid this overload, companies can implement specific countermeasures as soon as they recognize the overflow their employees’ experience. But if somebody is overloaded can not be answered directly by oneself; therefore it is necessary to use suitable constructs to measure email overload. This article includes a literature review to identify constructs to measure this phenomenon. From the field of information systems 55 highly ranked journals and conferences, furthermore 24 sources from the field of psychology were included. Finally, we could identify three different constructs by Dabbish and Kraut (2006), Hogan and Fisher (2006), and Sumecki, Chipulu and Ojiako (2011) to measure email overload. Beyond that, the article focuses on the description of the development of these instruments, discusses advantages and disadvantages, and gives an outlook what should be improved in these instruments in the future.

Keywords (Required)

Constructs, email overload, information overload, literature review, measuring

MOTIVATION

Communication by the use of digital information and communication technologies (ICTs) has become essential in most industries (Allen and Shoard, 2005). Compared to traditional ways of communication the success of ICT is caused by the fast, cheap as well as time- and location-independent acquisition and distribution of information (Pinnow, 2008). Furthermore, the mobile access contributes to an increase of information availability (Allen and Shoard, 2005). Due to the immediate delivery of digital messages it makes hardly any difference whether you send them to a colleague who is located on the opposite desk in the same office or to an affiliate on another continent. Among ICTs used in companies, email is currently the most widely used medium (Burgess, Jackson and Edwards, 2005; Dabbish and Kraut, 2006). Therefore, this article focuses on the communication by email.

Along with these advantages, more and more a decrease in conscientiousness, how senders formulate messages or define the receivers, has been observed (Pinnow, 2008). In this way, employees are now facing new challenges regarding quality and quantity of information they have to process. If they feel overwhelmed by the information they receive, we talk about information overload (Dabbish and Kraut, 2006). Since this article focuses on email-induced information overload, hereafter we will use the term “email overload” synonymous to “information overload by email” or simply “information overload” (Barlow, 2003).

Email overload can not only have negative effects on the well-being of an individual employee but also have negative influences on the success of the company. According to a study from 2009, costs caused by information overload for the economy of the United States in 2008 amount about 650 billion US $ (Spira and Goldes, 2008). This result supports the assumption that there is an enormous necessity for companies to implement efficient countermeasures. To reduce email overload, it is first necessary to identify the occurrence of email-induced information overload at all. Since this phenomenon is not directly observable or testable, indicators must be used for measuring. The research question therefore is to identify constructs from the scientific literature, with which the occurrence of information overload by email can be measured.

THEORETICAL BACKGROUND

Information Overload / Email Overload

The topic of information overload has occupied different fields of research since the 1970s. Research in this area mainly took place in the fields of “Organization Science”, “Accounting”, “Marketing” and “Psychology” (Eppler and Mengis, 2004). The unexploited potential of the topic “information overload” in the field of information systems is illustrated by an
interdisciplinary scientific literature review on this subject published in 2004 by Eppler and Mengis. In this publication 97 relevant articles regarding “information overload” were identified. Only seven articles could be directly assigned to the field of information systems, six more articles are located at the interface between information systems and one of the other research fields mentioned above (Eppler and Mengis, 2004).

Currently, there is no consistent definition of the term “information overload” in the field of information systems. According to Park, Lee and Han, information overload occurs, “[…] when the volume of information supply exceeds the capacity of an individual” (Park et al., 2006, p. 198). Similarly, Liang, Lai and Ku describe information overload as the state when “[…] users are given more information than they can handle within a given time frame” (Liang et al., 2007, p. 49). Speier and Morris claim that “[…] overload occurs when there is more information available than necessary for processing a task and where this extraneous information has a detrimental effect on decision quality” (Speier and Morris, 2000, p. 368). These definitions make clear that the amount of information is one of the most important factors. Other definitions, such as “[…] many users experience information overload (IO) [as] a phenomenon of being unable to select relevant information” (Koroleva, Krasnova, Günther, 2010, p. 1) may show that there are further causes of information overload.

Causes and symptoms of information overload are the focus of previous research activities in the field of information systems; these are supplemented by countermeasures to reduce this overload (Eppler and Mengis, 2004).

![Figure 1. A conceptual framework to structure research on information overload (Eppler and Mengis, 2004, p. 330)](image)

Causes (figure 1) describe the reasons for information overload. One possible relationship between causes and symptoms is clarified in a short example: The amount of received information of an employee will be taken as one possible cause (Liang et al., 2007; Park et al., 2006; Speier and Morris, 2000). As a symptom of information overload the quality of decisions will be exemplarily examined (Eppler and Mengis, 2004). Considering the quality of the decisions of an employee, an increasing amount of information has initially a positive effect on it. But the effect of an increased decision quality reverses after reaching a certain amount of information. Therefore, this coherence between information quantity and decision quality can be seen as one example for information overload (Eppler and Mengis, 2004).

Countermeasures are visualized as link between causes and symptoms in figure 1. They begin at the symptoms and try to reduce information overload by a reduction of the causes (Edmunds and Morris, 2000). The challenge of successful countermeasures is therefore the knowledge of the relevant causes.

**Measuring**

The issue of measuring has engaged the science for decades, long before the topic of information overload became relevant. The English physicist Norman Campbell defined measurement as “[…] the process of assigning numbers to represent quantities” (Campbell, 1920, p. 267). The essential point therefore is the fact that a real situation or structure is transferred into figures and formal contexts. Orth defined measuring as the basis of science (Orth, 1974). According to him, without the implementation of exact measurements, the development of empirical sciences, especially that of the natural sciences, could not be imagined (Orth, 1974).

For performing, measurement variables are used; more precisely, the change of the dependent variables by modifying the values of the independent variables, is observed. Especially relevant in the context of this article is the distinction between manifest and latent variables. Manifest variables are observable or can be recorded directly. The question “How many emails do you receive per day?” can not be answered necessarily directly, but the number of received emails per day can be traced in the inbox. Latent variables are not directly observable (Backhaus, Erichson, Pinke and Weiber, 2006). Consequently, it is very difficult to give a general answer to the question “Are you overwhelmed by the number of incoming emails per day?”. Therefore, information overload must be requested indirectly and is in very few cases directly observable. In this context,
indicators play a crucial role. Indicators are manifest variables that act as a substitute for the latent variable (Brosius, Koschel and Haas, 2009).

This relationship is illustrated below using a section of the construct by Dabbish and Kraut (2006), which is to be discussed in detail later. Exemplary indicators of these construct to measure email overload read as follows:

1. "I can handle my email efficiently. [...]"
2. "I have trouble finding information in my email. [...]" (Dabbish and Kraut, 2006, p. 434).

Thanks to such indicators, it is possible to measure a non-observable phenomenon. In the application of indicators, following criteria need to be considered (Brosius et al., 2009):

- Indices reduce the range of the attributes, differentiated descriptions of individual indicators will get lost.
- The index is the sum of all measured characteristics, and is even a new characteristic.
- The index must describe the range of the attributes, the indicators of a theoretical construct, completely and one-dimensional.
- The index itself has the level of an interval scale, even if the indicators embodied in it were collected nominal (yes/no) or ordinal.
- The measurements, which were integrated into the index, should have the same scales, thus e.g. nominal, dichotome scales.

Taking these criteria, it is possible to quantify a complex construct by measuring. However, it should be noted that this approach also brings disadvantages because it is always a reduced, abstract representation of the object under investigation (Brosius et al., 2009).

**RESEARCH DESIGN**

To answer the research question, we conducted a comprehensive literature review during the 4th quarter of 2011 which follows the guidelines of Webster and Watson (2002). According to Eppler and Mengis (2004), the topic of “information overload” has a strong conjunction to the field of psychology; therefore, we covered highly ranked journals and conferences out of both fields: From the field of “information systems” we included 55 journals and conferences, further 24 sources from the field of “psychology” were investigated. Since our research question concentrates on scientific constructs, the limitation on these sources seems to be appropriate.

In addition, Microsoft Research, IEEE Xplore and the electronic library AIS Electronic Library were included in the search for relevant articles. The keywords initially used were “email overload”, “e-mail overload” and “information overload”. We deliberately defined no restrictions on the specification of page numbers or publishing dates. Due to the relatively wide range of the term “information overload”, in the first step a very large hit rate could be achieved. Many of these results could only be rarely associated with email overload, so that the term “information overload” of the initial keyword list was subsequently excluded. After searching articles matching the search criteria, the hits were selected concerning their relevance for answering the research question:

By applying the defined keywords in a first step, 270 articles could be identified in which the terms “email overload” or “e-mail overload” were present (figure 2).

In a second step, further articles were rejected by reading the abstract, introduction, and conclusion. The remaining 48 hits were all read, fully assessed and subsequently classified as relevant or not relevant for answering the research question. As a result of this selection, three constructs could have been filtered out for the measurement of information overload by email. These are described more precisely in the following chapter.
RESEARCH RESULT

The identified approaches were developed by Dabbish and Kraut (2006), Hogan and Fisher (2006), and Sumecki et al. (2011). In the following chapter, the identified constructs are briefly presented in alphabetical order of the first authors. Furthermore, it is discussed how the authors have proceeded with the identification and validation of the constructs, which quality criteria the constructs have and what restrictions were accepted in each case.

Dabbish and Kraut

In 2006, Dabbish and Kraut published the article “Email overload at work: An analysis of factors associated with email strain” (Dabbish and Kraut, 2006). The authors define the term email overload as “[...] email users’ perceptions that their own use of email has gotten out of control because they receive and send more email than they can handle, find, or process effectively” (Dabbish and Kraut, 2006, p. 431). Furthermore, they underline the fact that the use of email today is the most widespread form of communication and email overload therefore increasingly becomes a problem. Therefore, they developed a study to answer the following research questions:

- Is email overload a distinct and measurable concept or is it simply a reflection of more general, communication intensity, work life, or role overload at work?
- Is email overload simply a function of email volume or do other job-related and communication-related factors have an influence? In particular, are there certain email management strategies that help people deal with a large volume of email?
- Does email overload have discernable consequences for the individuals and organizations that experience it?” (Dabbish and Kraut, 2006, pp. 414-432).

To answer these research questions, they conducted a national survey of white-collar workers in the United States. A total of 3900 randomly selected people were contacted via email. 484 people filled out the survey completely, so that their answers could be included in the analysis. The core of the article was the analysis of the “[...] relationship between email use and feelings of email overload and task coordination” (Dabbish and Kraut, 2006, p. 431). Based on the results, the authors developed a research framework (figure 3) to test the “[...] relationship between job characteristics, email communication, email management strategies and feelings of email overload” (Dabbish and Kraut, 2006, p. 432).

Figure 3: Research Framework by Dabbish and Kraut (2006, p. 432)

Because the focus of the article by Dabbish and Kraut is the measurability of email overload, the overall model (figure 3) will only be discussed briefly in the following: The variable “Job characteristics” contains several aspects. First, it illustrates a web of relationships, also called “relational complexity”. This includes the number of persons to whom one is in contact and the number of projects which one has to do. In addition, this variable also includes aspects such as interdependence, autonomy, and task variety. Furthermore, the number of meetings people attend every week will be included. Figure 3 also shows that the variable “Job characteristics” is associated with the following variables: “Email work importance”, “Email volume”, “Email management tactics”, and (indirectly) “Email overload”. The authors developed measuring constructs for the single factors described above.

Especially relevant for the research question of this paper is the variable “Email overload”. To measure this construct, Dabbish and Kraut developed the following indicators:

1. “I can handle my email efficiently. (R)
2. I have trouble finding information in my email.
3. I can easily deal with the amount of email I receive. (R)
4. I sometimes miss information or important messages.
5. I reply quickly to the messages I need to. (R)
6. Dealing with my email disrupts my ongoing work.

These indicators are based on the feelings of email overload, the impression that the ability to handle email was out of control. For this reason Dabbish and Kraut developed a five-point-likert-scale (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, and 5=strongly agree) with the seven items mentioned above regarding different statements about efficacy of email use. The participants rated their agreement with each statement.

The scale had a Cronbach’s alpha of 0.82; this coefficient illustrates the strength to which the indicators of a construct are correlated with each other. Therefore, the construct can be seen as highly reliable because the items loaded quite good on one factor in a confirmatory factor analysis. This result shows that it seems possible to make email overload measurable by the use of defined indicators.

Despite this positive value, Dabbish and Kraut limited their results in terms of validity and generalizability. Particularly relevant is the fact that several characteristics of email itself are not part of the model. Beyond the email volume the quality, relevance and layout of the email content also seems to have significant impact on the perceived email overload; furthermore, important moderating variables like age or gender are not included in the construct by Dabbish and Kraut (Kammerer, Hetzenecker, Sprenger and Amberg, 2012). Regarding these limitations it seems questionable whether the construct has the competence to capture the phenomenon of email overload overall.

**Hogan and Fisher**

Another construct to measure email overload was developed by Hogan and Fisher in the article “A Scale for Measuring Email Overload” (Hogan and Fisher, 2006). The authors created ten indicators to measure the latent variable. These will measure the existing information overload by email at work and are also – like the indicators of Dabbish and Kraut – very email-specific.

For the purpose of this study, the tool SNARF – which was developed by Microsoft – was used in a modified version. According to the developers of this tool, it intends to help users of Outlook to keep the overview of their emails and organize their own inbox more efficiently. SNARF is the abbreviation for “Social Network and Relationship Finder”. It browses the mailbox and conducts, according to Microsoft, a “social sorting”. The tool tries to determine the importance of emails by, for example, considering how often the receiver was in contact with the sender of the mail in the past. When someone has frequent contact with a friend, then “SNARF” will store this information automatically and prioritizes incoming emails of this person higher than other messages (Hogan and Fisher, 2006).

The authors deployed SNARF in a large software development organization. The users of the tool were asked to complete an optional survey about their experiences with email. After six weeks, the authors distributed a second survey to all participants of the first survey. 292 people completed the pre-survey, while 161 persons filled out the post-survey; from these persons 122 filled out both questionnaires. The used questionnaire is based on a survey of Neustaedter, Brush and Smith (2005) which deals with selection techniques of emails and email overload. In total, the authors asked users to respond to ten questions; six questions are from the previous study of Neustaedter et al. (2005), while four new questions were additionally added by Hogan and Fisher (2006). The users rated their answers on a five-point-likert scale ranging from “strongly disagree” (-2) to “strongly agree” (+2).

As result of the survey, a broad spread within the responses could be identified so that no single criterion was particularly prominent. For this reason, it is not possible to evaluate one single question as a clear indication to measure email overload. It was also found – by performing an exploratory factor analysis – that eight of the ten questions provided a decisive contribution to the representation of email overload, while the two remaining questions could not be confirmed regarding its relevance. The final email overload indicators read as follows:

1. “I feel I spend too much time keeping up with my mail
2. Email cuts into the time I wanted to spend on other tasks
3. I have trouble keeping up with email on days I am away from my desk
4. I got too much email
5. I spend too much time getting rid of unimportant messages
6. I am satisfied with the strategy I use to keep up with my mail (reverse coded)
7. When I return from vacation/time off, I feel overwhelmed when triaging my mails
8. Sometimes my emails may get lost or missed” (Hogan and Fisher, 2006, p. 1).

These eight indicators reach a Cronbach’s alpha of 0.86 and even seem to be slightly better than the indicators of Dabbish and Kraut (0.82). In addition, the indicators correlated according to Spearman’s rho “[…] ranging from .333 to .681 (p <0.01 for all), indicating that the items are all generally associated with each other, but are not collinear […]” (Hogan and Fisher, 2006, p. 2).

As interim conclusion, it can be noticed that this construct also seems to be a potential instrument to detect email overload. As a limitation of the article it can be stated that the investigation – due to the use of the tool SNARF – only refers to users of Outlook. Although Outlook is still the market leader in the field of email clients, products like Novell Group Wise or Lotus Notes and other clients play a significant role in companies (Dabbish and Kraut, 2006).

Furthermore, the method of the tool “SNARF” to prioritize incoming emails by the frequency a user communicates with another user seems to be discussable; e.g. when a person communicates with a colleague – even in a semi-private context about lunch etc. – very often per day, then emails from this person will get a higher priority than messages from your direct supervisor.

Sumecki et al.

The third identified construct to measure email overload was published by Sumecki et al. in the article “Email Overload: Exploring the moderating role of the perception of email as a ‘business critical’ tool” (Sumecki et al., 2011). This article focuses on answering the following research questions:

• “What, if anything, affects an individual’s generation of non-business critical emails?
• Is there a systematic link between time spent on non-business critical emails and the level of ‘email overload’ experienced by individuals?”(Sumecki et al., 2010, p. 408).

To answer these questions an online-based survey was also conducted in this article. Employees of a multinational technology firm head-quartered in England were selected as participants. After a testing phase, the survey was submitted via email to 7400 employees of the selected company. In total, 710 usable answers were counted, which corresponds to a return rate of about 9.5%.

In analogy to the study of Hogan and Fischer and contrary to Dabbish and Kraut, Sumecki et al. conducted the survey among the employees of one single company. Based on a literature review, Sumecki et al. established that it is possible to “[…] measure the level of email overload that an individual had experienced as a multi-dimensional construct by asking them to state their level of disagreement or agreement to the following three statements” (Sumecki et al., 2011, p. 409):

1. I believe there is a problem with “email overload” at work […]
2. Emails have a negative impact on my ability to get the job done […]
3. Emails are cause of personal stress […]” (Sumecki et al., 2011, p. 409).

These three questions were part of the online-based questionnaire mentioned above, where the respondents were able to express their opinion on a seven-point-likert-scale (from “very strongly disagree” to “very strongly agree”). The construct reached a Cronbach’s alpha of 0.74. Therefore, it can be seen as reliable, but the strength to which the indicators correlate with each other seems to be lower compared to the constructs described above.

As further result from the questionnaire, a regression model was built up (figure 4). These factors represent the influence factors and the relationship direction for the “Email Overload Experienced”.
The used approach offers the advantage that the influence of different corporate cultures can be kept low so that the type of email usage behavior is primarily attributed to the individual. Reverse, this leads to the most important limitation of this article because it was not checked whether the measuring instrument works for other companies at all. Possible reasons for different effects could be seen in specific corporate cultures for example. In addition, the authors themselves note that, “[...] our regression model of email overload, similar to previous research, explains about a quarter of the variation in email overload. This suggests there may be other important factors that need be included in the model [...]” (Sumecki et al., 2011, p. 413).

Discussion

At first sight it seems surprising that the identified approaches were all published in the field of information systems, because the pre-examination led us to the conclusion that the investigated issue was also paid particular attention in the field of psychology (Eppler and Mengis, 2004). Certainly, it seems that the issues of workload, stress, burn-out etc. play a major role in psychology, but the focus on the medium email is very specific and can be seen as one explanation for this finding.

Table 1 gives a brief overview of the identified constructs and shows that all three instruments seem to be suitable for measuring email overload:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study participants</th>
<th>Research method</th>
<th>No. of indicators</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabbish and Kraut, 2006</td>
<td>White-collar workers/national survey (USA)</td>
<td>Survey (484 valid responses)</td>
<td>7</td>
<td>0.82</td>
</tr>
<tr>
<td>Hogan and Fisher, 2006</td>
<td>Employees of a large software development organization (Canada/USA)</td>
<td>Pre-survey (292 responses); post-survey, six weeks later (161 responses) 122 persons filled out both surveys</td>
<td>8</td>
<td>0.86</td>
</tr>
<tr>
<td>Sumecki et al., 2011</td>
<td>Employees of a multinational technology firm (England)</td>
<td>Survey (710 valid responses)</td>
<td>3</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Table 1: Identified Constructs – Overview

Due to the respective values for Cronbach’s Alpha, which illustrates the reliability of all the three constructs, they should not be used without critical abbreviation. So the number of indicators of the construct by Sumecki et al. (2011) seems to be very small; if only one of these items were deleted during the implementation of a factor analysis, the result actually would be useless. Furthermore, the Cronbach’s Alpha of this construct is by far the poorest compared to the values of the other two instruments. Regarding to Backhaus et al. (2006), a Cronbach’s Alpha equal or greater 0.70 means adequate reliability, while a value from 0.90 or greater means high reliability.

In contrast to that, both the number of the single indicators and the values of Cronbach’s Alpha seem to be much better when we look at the constructs of Dabbish and Kraut (2006), and Hogan and Fisher (2006). But these approaches should not be used without dignifying the development in a critical way either. In both cases, the validation of the constructs was conducted with employees from the United States of America, respectively Canada and the United States of America. In general, this
raises the question, whether the construct also works with employees from other countries, or continents like Europe; these employees could have totally different attitudes regarding the use of emails, depending on the specific national culture.

Also the technologies using emails were not considered explicitly in the research approach and the identified constructs. While in the year 2006 (Dabbish and Kraut, 2006; Hogan and Fisher, 2006) the use of smartphones and tablet PCs was not that usual, five years later (Sumecki et al., 2011) these technologies were quite common.

Apart from that, some more constraints were set during the development of the constructs. Hogan and Fisher, for example, concentrated on Microsoft Outlook, so the applicability for the users of other email-clients was not tested in their article.

CONCLUSION

Especially by the properties of digital information and communication technologies, the overload of employees by information increased dramatically in the last few years. Regarding this topic, the use of emails can be seen as particularly relevant, because emails are used in nearly all companies today and can also be used to share information and communicate with affiliates outside the own company. Email overload can have negative impacts on job satisfaction, motivation and efficiency of the employees, but also on the company’s success. To remain competitive, it is therefore extremely important for companies to determine occurring information overload very quickly in order to reduce it with appropriate countermeasures.

Therefore, the basic fundamentals of “information overload by emails” and measurability in general were discussed at the beginning of this article. To avoid or reduce email overload, it is essential to recognize its occurrence. As mentioned above, it is not possible to ask people directly to which degree they feel overloaded by emails. For that reason, it is necessary to make email overload visible by using proved instruments. The intention of this article was to identify constructs from the scientific literature to measure email overload. As research method we conducted a literature review of highly ranked journals and conferences out of the fields of “information systems” and “psychology”.

Additional to the technical limitations of the identified constructs described above in the “Discussion”-section, the restriction on specific sources can be seen as the most important limitation of this article. For that reason, it can not be excepted that in other research areas (e.g. organization science, accounting or marketing) further relevant approaches have also been developed (Eppler and Mengis, 2004). To reduce this limitation, it seems useful to extend this literature review by including more sources. As also mentioned above, due to the concentration on “email overload” we defined our keywords and excluded the more general term “information overload” because it seems to reveal only results which do not focus on the medium email. Nonetheless, it could not be guaranteed that – due to this limitation – further articles with relevant constructs were excluded in advance.

The advantages and disadvantages of the identified instruments can be used as a basis to create a new construct without the restrictions mentioned in this article. As already described in the “Discussion”-section, it should contain indicators which additionally observe the culture, the used technology et cetera. This construct could be integrated in a measuring instrument within companies to identify email overload. Surveys could be implemented at regular time intervals which contain items of these constructs to track the progress of email overload. In most companies target agreements at the beginning of a business year between the employees of a company and their line manager are usual. As part of this process the employees could fill out a standardized questionnaire which contains also a construct regarding email overload; this would ensure a constant check without implementing a totally and additionally new process. As a possible interpretation, companies could realize whether implemented countermeasures reduce or even avoid email overload and which new countermeasure seems to be effective.

REFERENCES