A COGNITIVE LEARNING PERSPECTIVE ON ENCODING AND DECODING E-MAILS

Complete Research

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Abstract

The high e-mail amounts that individuals sent back and forth each day are one of the major causes for information overload. Knowledge seems to help overcoming information overload. However, it is not clear which knowledge areas are helpful. Therefore, we examine knowledge areas supporting the encoding and decoding of e-mails by investigating cognitive processes that allow knowledge building to avoid e-mail induced information overload. A novel theoretical perspective is developed which draws on knowledge as acquired schemas which allows bypassing working memory through automation. We employed a case study design which results in a conceptual model relating three knowledge areas: (1) channel knowledge, (2) message topic knowledge, and (3) communication partner knowledge. By drawing on cognitive load theory, we explain how these knowledge areas allow the reduction of e-mail induced cognitive load as a conceptualization of information overload.

Keywords: Information Overload, E-Mail Overload, E-Mail, Encoding, Decoding, Knowledge, Cognitive Load Theory, Cognitive Load, Case Study.

1 Introduction

The high e-mails amounts that individuals are sending and receiving and are one of the major causes for information overload in organizations (Dabbish and Kraut, 2006; Schultz and Vandenbosch, 1998; Sumecki et al., 2011). *Information overload (IO)* is present when there is too much information to process for an individual (Schroder et al., 1967). Previous research identifies "information technology and its use and misuse" as major contributors towards IO (Eppler and Mengis, 2004, p. 331). Information technologies that supposedly induce information overload to individuals include the Internet and most importantly e-mail (Bawden, 2001; Schultz and Vandenbosch, 1998; Sumecki et al., 2011).

The presence of high amount of e-mails and workers that are drowned by e-mails are a well-researched field (Adam, 2002; Girrier, 2003; Ingham, 2003; Whittaker and Sidner, 1996). Beyond previous research efforts on the presence of high amounts of e-mails, we still "…lack a deep understanding of the impact that e-mail has had on our lives…" (Weber, 2004, p. iii) in terms of the process behind that phenomenon. As e-mail overload is still a problem today (Grevet et al., 2014), we analyze in our study the cognitive processes of processing, reading, and writing e-mails as major contributors towards information overload. Knowledge has been identified as a factor in reducing the probability of IO (Swain and Haka, 2000) and trainings for building up knowledge have been suggested to cope with large amounts of e-mails (Soucek and Moser, 2010). However, the cognitive processes of e-mail processing by individual persons are hardly considered. Therefore, the precise roles of different knowledge areas as inhibiting factors to overcome e-mail induced IO are not well understood. We focus on the investigation of cognitive processes acquiring knowledge to reduce e-mail induced IO in terms of schema acquisition and automation. We intend to answer the following research question: *"Which are the knowledge areas reducing cognitive load and therefore e-mail induced IO?"*

We aim for (1) a novel theoretical perspective on knowledge to cope with e-mail overload, including a conceptual model, and (2) for guidance and suggestions for future research and practice. We draw on Cognitive Load Theory (CLT) (e.g., Sweller et al., 2011) as theoretical frame to explain IO and the cognitive processes required to effectively encode and decode e-mail messages. A case study design in a large-sized banking organization is used to explore e-mail overload based on CLT in a specific industry sector (Tarafdar et al., 2013). Data collection is based on thirteen semi-structured interviews, which leads to three distinct knowledge areas that are effective to reduce the amount of e-mail induced cognitive load. These knowledge areas are: (1) channel knowledge, (2) message topic knowledge, and (3) communication partner knowledge.

The remainder of the paper is structured as follows. Section 2 presents related work and the theoretical background of our study. Section 3 introduces the research design and method. We then describe the analysis procedure of our case study data. In Section 4 the empirical results of the study are presented and we propose our conceptual model and propositions for future research. Finally, we discuss our findings and conclude in Section 5.

2 Related Work and Theoretical Background

2.1 Information overload and e-mail

IO is an ambiguous term and one basic, straight-forward definition refers to IO as an "excessive supply" (Savolainen, 2007, p. 614) of information (e.g., Gill, 1998; Sumecki et al., 2011). Other research associates the phenomenon of IO with an inverted "U" curve since decision accuracy decreases beyond a certain amount of information (Schroder et al., 1967). Eppler and Mengis (2004) coined IO as a state that arises when information processing requirements are greater than available human information processing capacities, which we use for our research. Information processing requirements refer to "a given amount of information that has to be processed within a certain time period" (Eppler and Mengis, 2004, p. 326), which is based on the information processing view of organizations (Galbraith, 1974; Tushman and Nadler, 1978). If the amount of information that has to be processed exceeds the capacity of the human brain, IO occurs (Berghel, 1997; Heylighen, 2004; Kirsh, 2000). Besides the amount of information, other factors influence the occurrence of IO, for example, the complexity (Plumlee, 2003; Schneider, 1987) and ambiguity of information (Schneider, 1987), as well as task-related factors such as task complexity (Bawden, 2001) and task interruption (Speier et al., 1999).

Computer-mediated communication within organizations is another factor related to IO (Hiltz and Turoff, 1985). Message filters are found not very helpful because e-mail readers cannot distinguish between valuable or not valuable messages until they have processed it (Pavlov et al., 2008). Specifically, the large quantities of e-mails that are sent back and forth in every day working life considerably contribute to IO, which led to the term “e-mail overload” (e.g., Dabbish and Kraut, 2006; Ducheneaut and Bellotti, 2001; Ingham, 2003; Sumecki et al., 2011). Previous research investigated this phenomenon by either the actual or perceived amount of e-mails sent and received, or by the actually needed or perceived time needed for working on e-mails (Sumecki et al., 2011). Other research analyzed the role of interruptions due to e-mails, and the optimal time interval for checking e-mails (Gupta et al., 2013; Gupta et al., 2011; Renaud et al., 2006; Vidgen et al., 2011). We conclude that previous literature used ambiguous definitions of e-mail overload, and focused mostly on a performance perspective. We, therefore, define e-mail overload as e-mail induced information overload (Sumecki et al. 2011) to investigate a cognitive perspective in which we are interested in.

2.2 Cognitive load through encoding and decoding of e-mails

E-mail as a communication channel does not transport important information the interlocutors might use in face-to face communication to reach mutual understanding. Especially auditory and visual stimuli are typically missing when using e-mail. Therefore, e-mail requires special attention when formulating the messages. The respective additional tasks required to compensate for these missing stimuli are tied into an activity called *encoding*. Typically, e-mail senders spend effort to formulate the message in a way that is appropriate for the intended addressee, relying on the context the addressee might understand, considering the addressee’s knowledge required for a correct interpretation (Kock, 2007). This leads to special attention concerning the message’s formulation, structure, and correctness. Encoding as an activity comprises these kinds of tasks. Because of increased ambiguity and the missing cues when using email more effort for encoding of messages evokes higher cognitive load compared to face-to-face communication (Kock, 2001a; Kock, 2001b; Kock, 2004; Kock, 2005; Kock, 2009). The encoding of electronic communication has been observed for several media, e.g., for telephone by a higher amount of expressions of agreement and disagreement (Short et al., 1976) and for several senses e.g., vision by describing physical appearance (Walther, 1997). Like encoding, the receiver of a message needs to *decode* the e-mail which also induces cognitive load because of the absence of stimuli (Kock, 2001a; Kock, 2001b). This has been observed by investigating the resulting ambiguity e.g., perceiving constructive criticism as personal attack (Alonzo and Aiken, 2004; Markus, 1994). Therefore, e-mail communication requires encoding during the writing of e-mails and decoding during the reading of e-mails which increases the cognitive load.

2.3 Cognitive load theory

In order to better understand IO in relation to human information processing capacity, *cognitive load theory (CLT)* has been suggested (Sweller, 2010; Sweller et al., 2011; Sweller et al., 1998; Van Merriënboer and Sweller, 2005; Van Merriënboer and Sweller, 2010). The basic statement of CLT is that the cognitive load of the human brain is influenced by (1) information it is exposed to and (2) the representation of this information.

Of critical importance is the area of the human brain called working memory. Working memory corresponds to consciousness (Sweller et al., 1998). One task of working memory is schema creation, which is needed for relating new information with existing knowledge (Sweller, 2010; Sweller et al., 2011). A schema is defined as “a cognitive construct that organizes information according to the manner in which it will be dealt” with (Sweller and Chandler, 1994, p. 186). For example, when reading a text, a schema allows the extraction of meaning from looking at some words without reading the whole sentence (Sweller and Chandler, 1994).

The human consciousness is highly limited because the capacity of the human brain to process information simultaneously is strictly limited (Paas et al., 2004). Previous research found differing quantifications for this effect: for example, Miller (1956) claims that working memory is restricted to hold seven chunks of information at the same time, whereas Cowan (2001) quantifies this effect as around four items when processing information. Therefore, working memory is the restriction that supposedly causes the IO phenomenon to a large extent, which is due to limited information processing capabilities (Chen et al., 2011; Chen et al., 2012). We posit that if there are more chunks of information to process than there is free capacity in the working memory, a bottleneck occurs, which is called IO.

In addition, CLT offers explanations of the long-term memory and its relation to the human cognitive architecture. The task of schema acquisition is to store information in long-term memory (Chi et al., 1982). This reduces processing from working memory by activating long-term memory as the major learning mechanism (Sweller and Chandler, 1994). In contrast to the limited capacity of working memory, the unlimited capacity of long-term memory is used to store and unconsciously automate the execution of those schemas (Shiffrin and Schneider, 1977). Schemas allow the reduction of cognitive load by switching from conscious to automated unconscious processing (Schneider and Shiffrin, 1977). Learning is the process of creating those schemas in long term memory and depends on learning time and practice (Sweller et al., 1998). The resulting unconscious application of schemas in terms of knowledge enables us to bypass the limited capacity of working memory (Sweller and Chandler, 1994). This is how knowledge based on learning has the potential to overcome cognitive load in given situations.

To sum up, working memory is the bottleneck for information processing by humans, CLT is used to explain that learning builds up knowledge on how to encode and decode e-mail messages. As this avoids cognitive load through unconscious automation, the probability of information overload caused by e-mails is decreased. Therefore, we investigate knowledge areas diminishing the increased cognitive load through the required encoding and decoding of e-mails.

3 Research Design and Method

We pursue an exploratory research strategy by conducting an intensive case study in order to develop a theoretical model for “explaining and predicting” (Gregor, 2006, p. 626) which knowledge areas are necessary to lower cognitive load during encoding and decoding of e-mails. Cognitive load of encoding and decoding of e-mail messages are of profound interest as high performance pressure and a high amount of communication requires high communication efficiency. We grounded our conceptual model on insights of our empirical data, CLT, and prior literature. We followed established guidelines (Dubé and Paré, 2003; Myers, 2009; Sarker et al., 2013) for conducting our exploratory case study by conducting interviews on the behavior of humans based on difficulties they perceive during the encoding and decoding e-mails. To investigate perceived difficulty is appropriate, as humans are able to assess cognitive load by perceived difficulty which is a common approach in cognitive science (e.g., Ayres, 2006; Marcus et al., 1996). It is not our intention to test any theory or existing model with our case study as we want to build a new conceptual model.

The setting of our case study is a subsidiary of a European major bank collaborating closely with the abroad headquarters. The collaboration and the type of work require a high amount of communication. The communication partners are mostly not in reach and also participants of other European subsidiaries are involved. Even though there are other communication technologies available (e.g., phone or instant messaging), the major part of the communication is taking place by e-mail. We consider our case site appropriate because of several reasons: First, because of the bank secrecy, special care about confidentiality is required when sending e-mails. This means employees need to be very restrictive with information sharing. Second, banks also have to follow the “need to know principle”, which means that each department is only supposed to have access to information relevant for their tasks, while being excluded from other departments required information. Third, the multinational character of our case site entails a high amount of e-mail communication because team members are often located in different countries, hindering direct face-to-face communication. Fourth, our case site is maintaining strong ties to stock exchange related departments, leading to a lot of e-mail communication. Lastly, information exchange is crucial in the banking sector because of high performance pressure and dynamic increase of regulations, which both leads to high communication requirements.

In total, we conducted fourteen interviews, including one pilot. Our interview guideline is semi-structured, starting with an open part in order to capture the initial thoughts of the interviewee on e-mail overload, without steering the interviewee in a predefined direction. Then a structured part follows. The questions in this part were informed by prior literature on IO and cognitive load and yielded towards the identification of acquired knowledge areas.[1] All interviews were conducted during personal visits at the case site and lasted 40 minutes on average. The interviews were audio-recorded, transcribed and the quotes were translated by the authors. After 14 interviews, we reached theoretical saturation, meaning that there were hardly any new insights, which led to an end of the data collection phase (Guest et al., 2006).

Table 1 contains detailed information on our key informants. We took special care in selecting interview partners that were required to communicate frequently in order to fully grasp the learning effect This was realized by choosing project participants, project managers, and line managers for which no standard communication procedures were established, as for dynamic and linked tasks, more communication is necessary in order to coordinate and collaborate with colleagues (March and Simon, 1958; Thompson, 1967). Data triangulation was reached by interviewing three female (23%) and 10 male (77%) employees, as well as persons on different organizational levels: 6 employees (46%) and 7 managers (54%).

#	Age	Gender	Tenure	Professional knowledge	Job role	Duration of interview
1	31-40	Male	5-10 Years	5-10 Years	Project Manager	00:48:38
2	41-50	Male	>10 Years	>10 Years	Line Manager	00:45:41
3	41-50	Female	>10 Years	>10 Years	Employee	00:53:36
4	31-40	Male	3-5 Years	3-5 Years	Employee	00:31:14
5	31-40	Male	5-10 Years	5-10 Years	Employee	00:33:50
6	41-50	Female	>10 Years	>10 Years	Employee	00:28:28
7	41-50	Male	5-10 Years	>10 Years	Employee	00:44:21
8	21-30	Male	1-3 Years	5-10 Years	Project Manager	00:32:31
9	51-60	Male	>10 Years	>10 Years	Employee	00:37:29
10	---[2]	Male	---	---	Line Manager	00:45:17
11	31-40	Female	5-10 Years	5-10 Years	Line Manager	00:34:39
12	41-50	Male	>10 Years	>10 Years	Line Manager	00:57:06
13	41-50	Male	>10 Years	>10 Years	Line Manager	00:29:30

Table 1. Overview and characteristics of key informants

We used the software MaxQDA[3] for coding. We started with seed codes in a rough, preliminary coding scheme based on concepts identified during our literature review. New detailed codes emerged inductively by engaging into an inductive-deductive cycle of constant comparison with prior literature (Eisenhardt, 1989). The codes were informed by prior work on CLT (Sweller et al., 2011; Van Mer-

[1] For reasons of space, the guideline has been omitted from this paper and is available from the authors on request.
[2] He did not agree on the recording and the collection of interviewee characteristics, however, we conducted the interview and took notes.
[3] http://maxqda.com

riënboer and Sweller, 2005; Van Merriënboer and Sweller, 2010), on IO in general (Eppler and Mengis, 2004; Jackson and Farzaneh), e-mail overload (Dabbish and Kraut, 2006; Ducheneaut and Bellotti, 2001; Ingham, 2003; Sumecki et al., 2011), and on computer-mediated communication (Kock, 2004; Kock, 2005; Kock, 2009). We coded categories, forming our main constructs, as well as the relationships between the constructs.

4 Analysis and Results

4.1 Identified categories

The list of final categories that emerged during coding of the interview transcriptions is shown in Table 2. The first three categories reflect the different knowledge areas: (1) channel knowledge, (2) message topic knowledge, and (3) communication partner knowledge. The other categories, (4) encoding of electronic messages and (5) decoding of electronic messages, reflect the activities the knowledge is applied to and are introduced based on computer-mediated communication related work.

Category	Description and definition	Key references
Knowledge areas		
(1) Channel knowledge	Knowledge about the appropriate and efficient use of the channel such as how to compose messages and how to convey different settings of formality.	Carlson and Zmud (1994); Carlson and Zmud (1999)
(2) Message topic knowledge	Knowledge about the content of the message such as task specific terminology or jargon helping to improve shared understanding.	
(3) Communication partner knowledge	Knowledge about the communication partner which is needed to tailor a message to the needs of a specific recipient.	
Activities		
(4) Encoding of electronic messages	Encoding of electronic messages is an activity in order to compensate for the absence of cues based on the missing stimuli in an electronic message.	Kock (2001b); Kock (2001a)
(5) Decoding of electronic messages	Decoding of electronic messages is an activity that is reconstructing absent cues due to missing stimuli in an electronic message.	

Table 2. Overview and description of the identified categories

The following analysis shows how these initial categories are enacted in our case study. We present our results based on the three knowledge areas differentiating the encoding and decoding of e-mails.

4.2 Channel knowledge

We found three distinct subareas of channel knowledge for encoding e-mails: (1) *structure of the e-mail*, (2) *formulation of the e-mail*, and (3) *correctness of the e-mail.*

(1) The *structure of the e-mail* is stated to be learned quickly. This holds for purpose dependent and purpose independent parts of the structure. While the purpose dependent part is aligned towards the optimal understanding of the main reason why a message is sent, the purpose independent parts of the structure are mostly the same and comprise among other parts the salutation, greetings, and flowery phrases.

"[...] routine is established quickly, as the e-mails written are always rather similar" (I1, Project Manager)

A very important aspect of the structure of an e-mail emerged from our data that is the appropriate word count of the message. On the one hand, the text needs to comprise all necessary details, but on the other hand, the text needs to be as short as possible. The author has to develop a subjective feeling for the appropriate word count. As the channel e-mail is asynchronous and does not allow for immediate reactions or any other cues than text, senders need to learn the right balance between shortness and required level of detail. In order to acquire this knowledge, feedback on the word count of sent e-mails is important for authors:

"[…] At the beginning, one sometimes writes an e-mail that is too long. Then one will receive feedback, saying it is a matter of fact that hardly anybody reads those e-mails, and that you have to focus on the essential points; so there is definitely a learning process there" (I4, Employee)

(2) We identified the *formulation of the e-mail* as a relevant subarea of required channel knowledge. Formulation skills appropriate for e-mails need to be developed. These skills comprise how to formulate, the choice of appropriate words and how to address a specific subject. The choice of words reflects the tone of the e-mail and grants politeness towards the receiver, which is also reflected by the greeting. Our data shows that interviewees try to be formal, though less formal than in a letter, but still more formal than as in face-to-face conversations. In order to find the appropriate wording, interviewees develop their own degree of formality. In addition, wording and degree of formality are influenced by the purpose of a message. For reoccurring purposes, interviewees create mental templates of appropriate wordings in order to simplify the formulation of these messages:

"[…] I also think, for certain things there is a standard choice of wording one uses." (I11, Line Manager)

(3) The *correctness of the e-mail* is the third subarea of channel knowledge for encoding messages. In order to avoid errors, the interviewees check their spelling, the receivers within the to-field in order to keep the bank secret, and reopen attached documents to check if they attached the correct ones to comply the need-to-know principle. As these are two more checks in comparison with other channels, the interviewees acquired the knowledge to unconsciously perform these checks which leads to a very low error rate:

"But there are also control mechanisms when writing an e-mail, for example, running the spell check before sending an e-mail or double-checking the recipients before sending, or re-opening the attachment that one sends together with an e-mail." (I1, Project Manager)

We only found one channel knowledge area regarding the decoding of e-mails that has an influence on the understanding of the e-mail and needed to be learned by the interviewees: When interviewees were copied into an existing e-mail thread, they struggled at the beginning with this procedure of reading. Existing e-mail threads require reading the passages from the bottom to the top but reading each passage top down. This procedure is quite unusual for presenting text to readers, but emerges during the conversation caused by several replies from different people or a conversation between two persons with a couple of responses. Therefore, this procedure of reading e-mails was something new to our interviewees and understanding of the overall context was not easy:

"At the beginning, it is hard to actually start reading the e-mail bottom up in order to understand the context. Yes, especially when one gets copied [is added to the CC] into some conversation one thinks: What is this actually about?" (I1, Project Manager)

Table 3 summarizes the identified subareas of channel knowledge.

Knowledge subareas	**Encoding definition**	**Decoding definition**
Structure of the e-mail	The structure of the message contains purpose dependent and purpose independent parts. A crucial factor of the structure is the word count of the e-mail.	The reading and understanding of e-mail threads requires decoding knowledge. The e-mail related procedure of reading messages is reading passages from the bottom to the top, but each passage top down.
Formulation of the e-mail	When writing e-mails, an appropriate level of formality has to be applied. E-	No quotes could be identified.

	mails are less formal than a letter, but more formal than face-to-face communication.	
Correctness of the e-mail	Before sending out an e-mail, the sender double checks the content, recipients and attachments of the e-mail.	No quotes could be identified.

Table 3. Subareas of channel knowledge

4.3 Message topic knowledge

In our data, two different subareas of encoding knowledge with the message topic emerged. The first subarea is *reoccurring messages* that have almost the same content with some variations. We found three typical examples: (1) meeting requests that are coordinating different people from different departments as well as e-mails to customers are something that is only changing slightly from a content perspective of the messages, and as soon as a person has a certain text template for these purposes, this text will be used often. (2) Coordination of project resources and the reporting of project progress are typically related to a certain schema or template of messages. And (3) messages coming along with attachments that contain the main part of the message:

„[..] that mainly contains for example project coordination, it is rather repetitive, it is about topics that frequently reoccur in everyday work. It is also because analysis and presentations are usually attached to the e-mail and do not require much information in the e-mail body." (I1, Project Manager)

The second encoding knowledge subarea with the message topic is what we call information fit and is about the use of the appropriate amount of information. As e-mail disables instant feedback, it is difficult to give the appropriate amount of context and information to the receiver. The right amount of information depends strongly on the message topics and their complexity. We found e-mail writers learned the appropriateness of required information for a given topic by trial and error. Receivers gave feedback whether the sender included the required amount of information. With too little information, the probability to get feedback is higher because receivers were unable to understand the message:

"When looking back, ten years ago, I just wrote things down, without thinking too much about it. Over time, one receives feedback from colleagues or other recipients, saying 'I did not understand this or that'. If there are queries, one starts learning which queries and check-backs from the recipients are likely and then I try to remember those and consider them in future e-mails." (I11, Line Manager)

Table 4 gives an overview about the identified subareas of encoding knowledge with the channel, its description and definition. We did not find any quotes for the decoding related message topic knowledge.

Knowledge subareas	**Encoding definition**
Recurring messages	Similar messages that only change in details, but those details are important.
Information fit	Senders have to consider the appropriate amount of information they include into messages, as no immediate feedback on the right amount of information is possible.

Table 4. Subarea of encoding message topic knowledge

4.4 Communication partner knowledge

Knowledge about the person means how well do communication partners know each other. It is one knowledge subarea that we identified in our data for encoding and it is mainly based on information which interviewees gathered by themselves. For our informants, it is important to get to know the other person in order to communicate appropriately with each other. At the beginning of a working relationship, most of our interviewees prefer to have a personal face-to-face meeting or a phone call in order to acquaint themselves with the communication partners. If the partner is already known, the understanding of an e-mail message is much easier. This knowledge area and trust is mainly built up with face-to-face meetings. In the following excerpt a project manager is talking about the need of meeting first face-to-face and building up trust in terms of knowledge about the person at the beginning of a project in order to communicate afterwards efficiently per e-mail:

„simply that trust is rather built by seeking to meet somebody in person, [..]. There is a different quality to that." (I1, Project Manager)

The second knowledge subarea that we identified is the *meaning* of the message. The meaning is what is associated with certain words and expressions by a person. Shared understanding needs to be developed and adapted between persons. An obvious cause of misfit is due to the use of different natural languages like English and German:

"When you write something in German as a native speaker and you think 'that is a great way of phrasing that', the other person [non-native speaker] may totally misunderstand it" (I3, Employee)

The third and last subarea of encoding knowledge with the communication partner is *emotional aspects* in messages as a subarea to build communication partner knowledge. In order to express emotions with the help of the e-mail channel, it is necessary to know the person well in order to foresee their reactions. The expression of emotional aspects is limited to specific situations when the probability of misunderstandings is very low. The same holds for irony or suggestive language:

„It is very difficult to use irony or suggestive language. To do that you have to know your counterpart really well, in order to expect him to understand that correctly" (I5, Employee)

With regards to the decoding of messages, we found two distinct but related knowledge subareas of the communication partner that are the same as for encoding of messages: (1) *knowledge about the person* and (2) *meaning*.

Knowledge about the person is important to understand what is encoded in the message and what related contextual information is necessary to understand the message. However, it cannot be transferred via the e-mail channel. The interviews show that this knowledge subarea is acquired during standard face-to-face meetings and collaborations. Based on knowledge about the sending person, decoding of e-mails is facilitated:

"There are some people that you always understand immediately. It depends on how well you know those people." (I3, Employee)

Meaning was the second subarea we identified for decoding. In order to decode the message properly, sender and receiver have to agree on a common language and build up shared understanding. This is especially valid when two completely different departments or persons have to work together. We found support for this especially for the decoding of messages between employee and supervisor. Over time, these two persons built up a shared understanding and a common language with an agreed meaning. The following excerpt shows that working close together helps to develop a meaning between to persons, even the wording was not perceived appropriate:

„I can tell you about my former boss: he wrote e-mails which I understood after a while even they were expressed strangely." (I3, Employee)

Table 5 summarizes the identified subareas of encoding and decoding knowledge with the communication partner.

Knowledge subareas	**Encoding definition**	**Decoding definition**
Knowledge about the person	Encoding of messages is easier when people know each other.	In order to decode a message appropriately, the communication partners should know each other.
Meaning	Communication partners have to be able to understand each other in order to grasp	In order to decode messages appropriately, the communication partners should have shared understanding about the meaning

	the full meaning of messages.	of relevant terms.
Emotional aspects	Emotional aspects such as irony or suggestive language should only be included when communication partners know each other well.	No quotes could be identified.

Table 5. Subareas of knowledge with the communication partner

4.5 Overview of identified knowledge areas

Overall, we could identify three knowledge areas that have an impact on the emergence of cognitive load during encoding or decoding of e-mail messages: (1) *channel knowledge*, (2) *message topic knowledge*, and (3) *communication partner knowledge*. Whereas we found support for all of them during the encoding of messages, we only found support for channel knowledge and communication partner knowledge for the decoding of messages. Consequently, we identified five different knowledge subareas that are relevant in terms of cognitive load induction: three encoding knowledge area and two decoding knowledge areas composed of eight subareas. Table 6 presents the final list of identified knowledge areas and their identified subareas.

Knowledge area	**Subareas for the encoding of e-mails**	**Subareas for the decoding of e-mails**
(1) Channel knowledge	Structure of the e-mail	Structure of the e-mail
	Formulation of the e-mail	---
	Correctness of the e-mail	---
(2) Message topic knowledge	Recurring messages	---
	Information fit	---
(3) Communication partner knowledge	Knowledge about the person	Knowledge about the person
	Meaning	Meaning
	Emotional aspects	---

Table 6. Knowledge areas and subareas

4.6 Conceptual model

Figure 1 presents our previous results as a conceptual model which answers our research question.

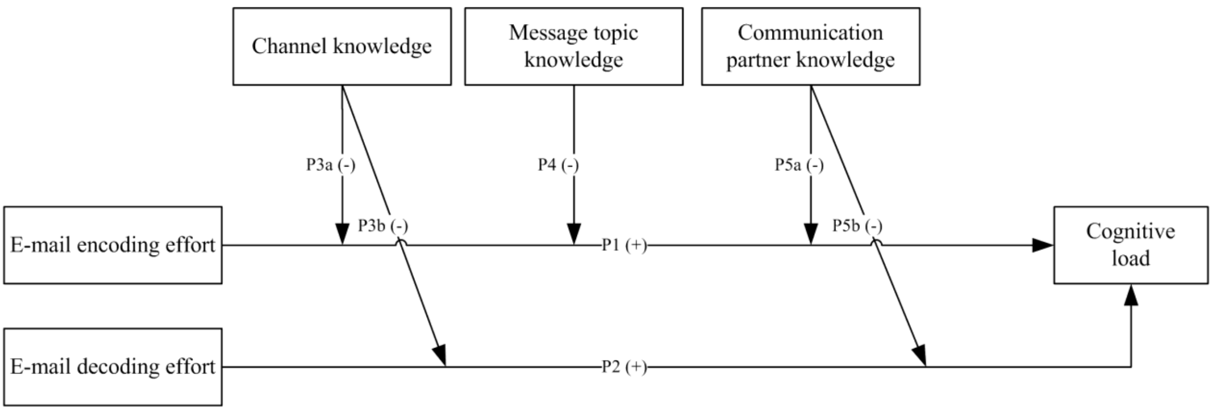

Figure 1. Conceptual model

The conceptual model is based on the collected empirical data and extant literature. The encoding and decoding of e-mails is based on insights from extant literature, which have also been supported by our empirical findings (propositions 1 and 2). The knowledge areas we identified are moderators to the relations between encoding and cognitive load, as well as decoding and cognitive load (propositions 3-5). The main contributions of our conceptual model are the three knowledge areas that have a moderating effect on the relationship of e-mail effort and cognitive load: (1) channel knowledge, (2) message topic knowledge and (3) communication partner knowledge.

As regards the encoding and decoding of e-mails, we draw on computer-mediated communication related literature (Kock, 2004; Kock, 2005; Kock, 2009) which posits that cognitive load is higher when using an unnatural communication channel, compared to face-to-face communication. As e-mail suppresses cues, e.g., auditory and visual stimuli, cognitive load is higher than in personal face-to-face communication. Especially the *encoding of messages* is an activity increasing cognitive load (Kock, 2001a; Kock, 2001b) in order to compensate for missing communication stimuli (Kock, 2007).

Proposition P1: An increase in e-mail encoding effort will increase cognitive load.

E-mail decoding in terms of "filling in the blanks" (Kock, 2007, p. 177) of absent communication stimuli leads also to a higher cognitive load (Kock, 2001a; Kock, 2001b). However, the burden of decoding in terms of suppressed stimuli is not that high as when encoding, but it is still present (Kock, 2007):

Proposition P2: An increase in e-mail decoding effort will increase cognitive load.

What we call knowledge in our model is scrutinized through the lens of CLT and it is drawing on schema acquisition and automation. In terms of encoding messages, we identified three subareas of *channel knowledge* that are needed for automation. The structure of an e-mail needs to be learned in order to encode efficiently what the sender wants to say. Regarding the context of an e-mail, mental formulation patterns or mental text templates simplify the message composition. Also, the correctness of e-mails, which needs to be checked because of the documenting character of the medium, benefits from knowledge. In terms of *decoding channel knowledge*, we identified possible schema areas as relevant with regards to e-mail: the e-mail thread structure, quoting existing e-mail conversations, which leads to an unusual reading of messages in comparison to the reading of conventional text material. Based on these possible schemas, we expect that a reduction of cognitive load during encoding and decoding. Because acquired schemas for the channel and unconscious automation allow bypassing working memory:

Proposition P3a: The positive relationship between e-mail encoding effort and cognitive load is reduced by channel knowledge.

Proposition P3b: The positive relationship between e-mail decoding effort and cognitive load is reduced by channel knowledge.

Message topic knowledge emerged in our data as knowledge that was only relevant for encoding messages, not for decoding messages. We found two different knowledge subareas that may lower cognitive load by schema acquisition and automation: reoccurring messages and information fit. Reoccurring messages, such as meeting appointments, project management coordination or project progress as well as the forwarding of attachments, need to be composed in detail but after schema acquisition only the details need to be changed. Information fit, however, refers to the right amount of information, not too much but also not too little for each topic in order to facilitate understanding of the communication partner. Based on these two subareas, we suggest a negative moderating relation on the relationship between e-mail encoding effort and cognitive load:

Proposition P4: The positive relationship between e-mail encoding effort and cognitive load is reduced by message topic knowledge.

Communication partner knowledge is a knowledge area that is relevant for encoding and decoding of messages. In terms of encoding e-mail message, we found that it is important to know about the communication partner in order to encode information appropriately for the respective person, context, and knowledge. Our informants stated that the meaning in terms of shared understanding on which the communication partners agreed in order to facilitate understanding is also important. Last but not least, emotional aspects like irony and suggestive language are only able to build on a sound knowledge about the person to avoid misunderstandings. We also identified *decoding communication partner knowledge* in our data that can be differentiated in two subareas: the knowledge of a person that helps decoding the message appropriately by knowing about the person's task, context and possible intensions, and second, meaning that requires a shared understanding as a schema in order to facilitate decoding. Because the acquisition of communication partners' dependent schemas leads to higher automation, we posit that cognitive load on the encoding and decoding of messages is reduced:

Proposition P5a: The positive relationship between e-mail encoding effort and cognitive load is reduced by communication partner knowledge.

Proposition P5b: The positive relationship between e-mail decoding effort and cognitive load is reduced by communication partner knowledge.

To sum up, the model shows the moderating effect of three knowledge areas on the encoding and decoding of e-mail messages: (1) channel knowledge, (2) message topic knowledge, and (3) communication partner knowledge.

5 Discussion and Conclusion

Based on our research question, we set out to identify different knowledge areas in order to reduce e-mail induced IO. Drawing on CLT and e-mail related literature, we interviewed 14 bank employees and managers about their acquired knowledge facilitating e-mail encoding and decoding. This is appropriate as we ask for perceived difficulty as it is used for assessing cognitive load as a conceptualization of IO. Three distinct but related knowledge areas emerged in our data: (1) channel knowledge as acquired schemas that help to use e-mail as a communication medium appropriately and efficiently, (2) message topic knowledge in terms of using efficient formulation with reoccurring messages and using the appropriate amount of information facilitating understanding, (3) communication partner knowledge in order to set the message in the context of the communication partner, facilitating understanding with the convergence of shared understanding and using emotional aspects in order to enrich communication. Furthermore, our findings led to a theoretically and empirically grounded conceptualization in terms of a conceptual model with the three identified knowledge areas as moderators on the relationship between either encoding or decoding of e-mails and the induction of cognitive load.

Our findings have important implications for research and practice. First, we provide empirical support of the applicability of instructional and cognitive theories in terms of CLT to the domain of IO in order to explain the acquisition of knowledge reducing e-mail induced IO. Consequently, we provide three knowledge areas based on CLT as potentially acquired schemas that can lower cognitive load in terms of automation through bypassing working memory as unconscious processing. We, therefore, do show which knowledge areas are crucial, for reducing cognitive load during the encoding and decoding of e-mails. We also contribute to the existing knowledge by discussing and gathering insights about the influence of knowledge on e-mail induced IO on an individual level. Our conceptual model posits that humans have a learning mechanism that allows acquiring knowledge for coping with e-mail induced information overload. This extends existing results of related literature (Swain and Haka, 2000) by opening the black box of how knowledge develops. By scrutinizing the lens of CLT, we explain how knowledge is built up by schemas encapsulating information in order to store it in long-term memory. As soon as schemas are stored in long-term memory, automated unconscious processing of the information is possible without allocating resources within working memory. Therefore, automation leads to a shift of cognitive processes from working memory to long-term memory by creating schemas for automation. Schema acquisition and the creation of knowledge are only possible when there is free cognitive capacity in working memory so that schema acquisition may be activated. Related studies (Carlson and Zmud, 1994; Carlson and Zmud, 1999; Timmerman and Madhavapeddi, 2008) also emphasized the fact of developing a knowledge base in contrast to spending time with a medium repeatedly, however, without analyzing the cognitive development processes and why these are important. Other studies (Rutkowski and Saunders, 2010; Rutkowski et al., 2013) focus on the emotional aspect in terms of whether an overload situation could be solved successfully or not. We extend this beyond emotional aspects by proposing a general knowledge perspective in terms of schema acquisition. Furthermore, we extend existing research (Soucek and Moser, 2010) by looking on the processing of each e-mail in order to facilitate encoding and decoding of an e-mail in contrast to lowering the amount of e-mails. This contributes to knowledge on how to get along with high amounts of e-mail by facilitating the processing of each e-mail.

Our identified knowledge areas are aligned to existing literature (Carlson and Zmud, 1994; Carlson and Zmud, 1999), but also providing further case details for these knowledge areas and identified e-mail specific subareas. In contrast to existing literature (Carlson and Zmud, 1999), we found qualitative support for message topic knowledge. This could be due to the uniform perceived richness construct (Timmerman and Madhavapeddi, 2008) or that we look at actual use of e-mail split into encoding and decoding of e-mails.

For future research, additional case studies are vital. Since we performed only one case in one organization, there might be other knowledge areas that need to be discovered by further research. Also, the relations call for subsequent investigations in order to find out whether there are other applicable relations towards encoding and decoding. In terms of e-mail, the existing subareas of knowledge can be intensified and further technologies are also worth to investigate. Additionally, there may be other positive and negative influences on cognitive load, e.g., interruptions (Gupta et al., 2013; Gupta et al., 2011; Renaud et al., 2006; Vidgen et al., 2011). In order to validate our findings, the propositions of our conceptual model need to be tested in detail (e.g., using laboratory experiments or field surveys). Constructs can be derived from our study and from literature on knowledge (Carlson and Zmud, 1999) and on encoding, decoding as well as cognitive load (Kock, 2007). Furthermore, we call for research that explores other human coping mechanisms unburdening human working memory in order to avoid IO.

As practical contribution, our case study suggests that for an efficient use of the e-mail channel, there are several important knowledge areas. For all of these knowledge areas, it is essential that there are enough free cognitive resources and people are not overloaded in order to activate schema acquisition and knowledge building. In terms of the three knowledge areas, we provide concrete suggestions in order to facilitate knowledge acquisition: (1) channel knowledge indicates the need for training not for the e-mail tool itself but how to craft messages efficiently so that the e-mails are easy to understand, (2) message topic knowledge, however, leads to the implication that humans should be allowed to spend enough time and effort at the beginning in order find the right formulation templates and the appropriate amount of information for each topic, and (3) communication partner knowledge suggests to limit the amount of new persons the sender is exposed to in order to learn iteratively. Furthermore, changing contact persons should be avoided for communication intensive, high pressure tasks.

Due to the limitations inherent in the case study methodology, it cannot be claimed that knowledge acquisition with regards to e-mail induced IO has been explored exhaustively in this article. For example organizational knowledge might be another helpful knowledge area (Carlson and Zmud, 1994; Carlson and Zmud, 1999). Also, without testing in a large scale environment, generalizability is not given, as we investigated only one case. Moreover, as we concentrated on e-mail, IO, and CLT, we did not employ other lenses for scrutinizing our data which may also play a role in this setting (e.g., dual process theory (Sun, 2002)). However, we described the applied method and procedures extensively in order to allow following the chain of evidence and we related our findings to existent theory. Furthermore, we performed several in case triangulations and during data collection, we identified a trend towards theoretical saturation. Therefore, we believe that we capture the essential findings of our case organization and extracted the relevant insights.

In order to identify relevant knowledge areas for reducing e-mail induced IO, we unveiled three different knowledge areas in a case study. We find that these three knowledge areas are comprised of eight subareas that allow us to build a theoretically and empirically grounded conceptualization. Those findings contribute towards opening the black box of how humans can cope with e-mail induced IO in organizations in terms of knowledge acquisition.

References

Adam, R. (2002). "Is e-mail addictive?" *Aslib Journal of Information Management* (54) 2, 85-94.

Alonzo, M. and M. Aiken (2004). "Flaming in electronic communication." *Decision Support Systems* (36) 3, 205-214.

Ayres, P. (2006). "Impact of reducing intrinsic cognitive load on learning in a mathematical domain." *Applied Cognitive Psychology* (20) 3, 287-298.

Bawden, D. (2001). "Information overload." *Library & Information Briefings* (92), 1-15.

Berghel, H. (1997). "Cyberspace 2000: Dealing with Information Overload." *Communications of the ACM* (40) 2, 19-24.

Carlson, J. R. and R. W. Zmud (1994). "Channel expansion theory: A dynamic view of media and information richness perceptions." *Academy of Management* (1994) 1, 280-284.

Carlson, J. R. and R. W. Zmud (1999). "Channel Expansion Theory and the Experiential Nature of Media Richness Perceptions." *The Academy of Management* (42) 2, 153-170.

Chen, C.-Y., S. Pedersen, and K. L. Murphy (2011). "Learners' Perceived Information Overload in Online Learning via Computer-Mediated Communication." *Research in Learning Technology* (19) 2, 101-116.

Chen, C.-Y., S. Pedersen, and K. L. Murphy (2012). "The influence of perceived information overload on student participation and knowledge construction in computer-mediated communication." *Instructional Science* (40) 2, 325-349.

Chi, M. T. H., R. Glaser, and R. Rees (1982). "Expertise in problem solving." *Advances in the psychology of human intelligence* (1).

Cowan, N. (2001). "The magical number 4 in short-term memory: A reconsideration of mental storage capacity." *Behavioral and Brain Sciences* (24) 1, 87-185.

Dabbish, L. and R. Kraut (2006). "Email overload at work: An analysis of factors associated with email strain." In: *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work.* Banff, Alberta, Canada, pp. 431-440.

Dubé, L. and G. Paré (2003). "Rigor in Information Systems Positivist Case Research: Current Practices, Trends, and Recommendations." *MIS Quarterly* (27) 4, 597-635.

Ducheneaut, N. and V. Bellotti (2001). "Email as habitat: An exploration of embedded personal information management." *Interactions* (8) 5, 30-38.

Eisenhardt, K. M. (1989). "Building Theories from Case Study Research." *Academy of Management Review* (14) 4, 532-550.

Eppler, M. J. and J. Mengis (2004). "The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines." *Information Society* (20) 5, 325-344.

Galbraith, J. R. (1974). "Organization Design: An Information Processing View." *Interfaces* (4) 3, 28-36.

Gill, S. (1998). "UK business information on the Internet." *New Library World* (90) 6, 238-242.

Girrier, R. P. (2003). "E-mail is a two-edge sword." *United States Naval Institute Proceedings* (129), 90-93.

Gregor, S. (2006). "The Nature of Theory in Information Systems." *MIS Quarterly* (30) 3, 611-642.

Grevet, C., D. Choi, D. Kumar, and E. Gilbert (2014). "Overload is overloaded: email in the age of Gmail." In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* Toronto, Ontario, Canada, pp. 793-802.

Guest, G., A. Bunce, and L. Johnson (2006). "How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability." *Field Methods* (18) 1, 59-82.

Gupta, A., H. Li, and R. Sharda (2013). "Should I send this message? Understanding the impact of interruptions, social hierarchy and perceived task complexity on user performance and perceived workload." *Decision Support Systems* (55) 1, 135-145.

Gupta, A., R. Sharda, and R. A. Greve (2011). "You've got email! Does it really matter to process emails now or later?" *Information Systems Frontiers* (13) 5, 637-653.

Heylighen, F. (2004). "Complexity and Information Overload in Society: why increasing efficiency leads to decreasing control." *The Information Society* (87), 1-19.

Hiltz, S. R. and M. Turoff (1985). "Structuring computer-mediated communication systems to avoid information overload." *Communications of the ACM* (28) 7, 680-689.

Ingham, J. (2003). "E-mail overload in the UK workplace." *Aslib Proceedings* (55) 3, 166-180.

Jackson, T. W. and P. Farzaneh (2004). "Theory-based model of factors affecting information overload." *International Journal of Information Management* (32) 6, 523-532.

Kirsh, D. (2000). "A few thoughts on cognitive overload." *Intellectica* (30) 1, 19-51.

Kock, N. (2001a). "Asynchronous and distributed process improvement: the role of collaborative technologies." *Information Systems Journal for East European management studies* (11) 2, 87-110.

Kock, N. (2001b). "Compensatory adaptation to a lean medium: an action research investigation of electronic communication in process improvement groups." *Professional Communication, IEEE Transactions on* (44) 4, 267-285.

Kock, N. (2004). "The Psychobiological Model: Towards a New Theory of Computer-Mediated Communication Based on Darwinian Evolution." *Organization Science* (15) 3, 327-348.

Kock, N. (2005). "Media richness or media naturalness? The evolution of our biological communication apparatus and its influence on our behavior toward E-communication tools." *Professional Communication, IEEE Transactions on* (48) 2, 117-130.

Kock, N. (2007). "Media naturalness and compensatory encoding: The burden of electronic media obstacles is on senders." *Decision Support Systems* (44) 1, 175-187.

Kock, N. (2009). "Information Systems Theorizing based on Evolutionary Psychology: An Interdisciplinary Review and Theory Integration Framework." *MIS Quarterly* (33) 2, 395-418.

March, J. G. and H. A. Simon (1958). *Organizations*. New York: Wiley.

Marcus, N., M. Cooper, and J. Sweller (1996). "Understanding instructions." *Journal of Educational Psychology* (88) 1, 49–63.

Markus, M. L. (1994). "Finding a happy medium: explaining the negative effects of electronic communication on social life at work." *ACM Transactions on Information Systems* (12) 2, 119-149.

Miller, G. A. (1956). "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *The Psychological Review* (63) 2, 81-97.

Myers, M. D. (2009). *Qualitative research in business & management*. London, England: Sage Publications Ltd.

Paas, F., A. Renkl, and J. Sweller (2004). "Cognitive Load Theory: Instructional Implications of the Interaction between Information Structures and Cognitive Architecture." *Instructional Science* (32) 1-2, 1-8.

Pavlov, O. V., R. K. Plice, and N. P. Melville (2008). "A communication model with limited information-processing capacity of recipients." *System Dynamics Review (Wiley)* (24) 3, 377-405.

Plumlee, M. A. (2003). "The Effect of Information Complexity on Analysts' Use of That Information." *The Accounting Review* (78) 1, 275-296.

Renaud, K., J. Ramsay, and M. Hair (2006). ""You've Got E-Mail!" ... Shall I Deal With It Now? Electronic Mail From the Recipient's Perspective." *International Journal of Human-Computer Interaction* (21) 3, 313-332.

Rutkowski, A.-F. and C. S. Saunders (2010). "Growing Pains with Information Overload." *Computer* (43) 6, 96-95.

Rutkowski, A., C. Saunders, M. Wiener, and R. J. A. M. Smeulders (2013). "Intended Usage of a Healthcare Communication Technology: Focusing on the Role of IT-Related Overload." In: *Proceedings of the 2013 International Conference on Information Systems (ICIS 2013)*. Milan, Italy.

Sarker, S., X. Xiao, and T. Beaulieu (2013). "Qualitative Studies in Information Systems: A Critical Review and Some Guiding Principles." *MIS Quarterly* (37) 4, iii-xviii.

Savolainen, R. (2007). "Filtering and withdrawing: strategies for coping with information overload in everyday contexts." *Journal of Information Science* (33) 5, 611-621.

Schneider, S. C. (1987). "Information overload: causes and consequences." *Human Systems Management* (7) 1987, 143-153.

Schneider, W. and R. M. Shiffrin (1977). "Controlled and automatic human information processing: I. Detection, search, and attention." *Psychological Review* (84) 1, 1-66.

Schroder, H. M., M. J. Driver, and S. Streufert (1967). *Human information processing; individuals and groups functioning in complex social situations*. New York: Holt, Rinehart and Winston.

Schultz, U. and B. Vandenbosch (1998). "Information Overload in a Groupware Environment: Now You See It, Now You Don't." *Journal of Organizational Computing & Electronic Commerce* (8) 2, 127-148.

Shiffrin, R. M. and W. Schneider (1977). "Controlled and automatic human information processing: II. Perceptual learning, automatic attending and a general theory." *Psychological Review* (84) 2, 127-190.

Short, J. A., E. Williams, and B. Christie (1976). *The Social Psychology of Telecommunications*. London, England: John Wiley & Sons.

Soucek, R. and K. Moser (2010). "Coping with information overload in email communication: Evaluation of a training intervention." *Computers in Human Behavior* (26) 6, 1458-1466.

Speier, C., J. S. Valacich, and I. Vessey (1999). "The Influence of Task Interruption on Individual Decision Making: An Information Overload Perspective." *Decision Sciences* (30) 2, 337-360.

Sumecki, D., M. Chipulu, and U. Ojiako (2011). "Email overload: Exploring the moderating role of the perception of email as a 'business critical' tool." *International Journal of Information Management* (31) 5, 407-414.

Sun, R. (2002). *Duality of the mind: A bottom up approach to cognition*. Lawrence Erlbaum Associates.

Swain, M. R. and S. F. Haka (2000). "Effects of Information Load on Capital Budgeting Decisions." *Behavioral Research in Accounting* (12), 171-198

Sweller, J. (2010). "Element Interactivity and Intrinsic, Extraneous, and Germane Cognitive Load." *Educational Psychology Review* (22) 2, 123-138.

Sweller, J., P. Ayres, and S. Kalyuga (2011). *Cognitive load theory*. New York, USA: Springer.

Sweller, J. and P. Chandler (1994). "Why Some Material Is Difficult to Learn." *Cognition and Instruction* (12) 3, 185-233.

Sweller, J., J. G. van Merrienboer, and F. W. C. Paas (1998). "Cognitive Architecture and Instructional Design." *Educational Psychology Review* (10) 3, 251-296.

Tarafdar, M., A. Gupta, and O. Turel (2013). "The dark side of information technology use." *Information Systems Journal* (23) 3, 269-275.

Thompson, J. (1967). *Organizations in action*. New York: McGraw-Hill.

Timmerman, C. E. and S. N. Madhavapeddi (2008). "Perceptions of Organizational Media Richness: Channel Expansion Effects for Electronic and Traditional Media Across Richness Dimensions." *Professional Communication, IEEE Transactions on* (51) 1, 18-32.

Tushman, M. L. and D. A. Nadler (1978). "Information Processing as an Integrating Concept in Organizational Design." *The Academy of Management Review* (3) 3, 613-624.

Van Merriënboer, J. J. G. and J. Sweller (2005). "Cognitive Load Theory and Complex Learning: Recent Developments and Future Directions." *Educational Psychology Review* (17) 2, 147-177.

Van Merriënboer, J. J. G. and J. Sweller (2010). "Cognitive load theory in health professional education: design principles and strategies." *Medical Education* (44) 1, 85-93.

Vidgen, R., J. Sims, and P. Powell (2011). "Understanding e-mail overload." *Journal of Communication Management* (15) 1, 84-98.

Walther, J. B. (1997). "Group and interpersonal effects in international computer-mediated collaboration." *Human Communication Research* (23) 3, 342–370.

Weber, R. (2004). "Editor's comments." *MIS Quarterly* (28) 3, iii-xiii.

Whittaker, S. and C. Sidner (1996). "Email overload: exploring personal information management of email." In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* Vancouver, British Columbia, Canada, pp. 276-283.