

Submission to Sub-theme 10

Information management practices: How knowledge workers act as amateurs when using information at work

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Abstract

The proliferation of Internet technologies in the workspace provides tremendous possibilities for knowledge workers to access vast amounts of information from a large number of sources. The information abundance offers new opportunities which empower the knowledge worker but at the same time may create information overload. This study explores academics' information management practices, by applying a theoretical framework build on three theoretical perspectives. These involve mindfulness, sense-making, and decision-making heuristics. The theoretical framework is used to analyse diary data about three tasks: email management, communication with colleagues, and information search. Our findings show that the knowledge workers have developed their own relatively simple but seemingly suitable practices for dealing with information overload and being empowered from the abundant information available to them. The relative amateurism and professionalism of the participants are discussed and limitations of this study as well as areas for future research are delineated.

1. Introduction

Traditionally, knowledge workers used information available to them through archival records, technical documents, and participation in professional and social networks. With the emergence of the Internet the availability and use of information became pervasive and continuous, creating both positive and negative effects on information management and decision-making at the workplace.

The Internet provides tremendous possibilities for knowledge workers to get access to vast amounts of information relevant to their work. This is a huge benefit for professionals who depend on information to perform their jobs. For example, a journalist may use a wide variety of information sources (such as blogs and on-line news agencies) to write articles; and a business manager may 'listen' to the customers' online discussions in order to make decisions about future products and services (also referred to as crowdsourcing). For these knowledge workers the access to meaningful and timely information can lead to information empowerment, understood as an increased ability to make better decisions. However, most knowledge workers have yet to be trained to use the numerous new information sources that the Internet provides access to, and thus, they mainly rely on their experience and intuition when they navigate the information highway (Sundar et al. 2007). This intuitive approach to the use of information available through the Internet can be viewed as amateurism. As such, it stands in contrast to the knowledge workers' professional approach to work in general and with regard to their specific profession in particular.

The lack of training and resulting amateur behaviour might be problematic because the vast amount of information available on the Internet makes elicitation and management of relevant information difficult. Existing Internet research have looked at peoples' behaviour on the Internet as consumers (e-commerce), market players, or social beings (social networking). However, workplace practices for coping with information overload and harvesting the benefits of information available through the internet have not yet been studied extensively. The present study explores the knowledge workers information management practices in the workplace.

The study provides a new perspective on information management in the workplace. We propose a theoretical framework which brings together concepts from mindfulness, sense-making and decision making to investigate the knowledge worker's information management practices. To our knowledge this study is one of the first research attempts that use several theories to investigate different aspects of the cognitive processes involved in information management at work. As such we propose a new theoretical approach to the research field which provides a holistic view of the knowledge worker's use and management of information in different tasks in the workplace.

Following the research objective, the paper is structured as follows. First, we present insights from existing research on information management in the workplace. Second, we describe the

three theoretical approaches adopted to study the knowledge worker's use and management of information, and we depict the theoretical framework. Third, we offer a brief description of our research method, which is based on collection and analysis of qualitative data using diaries. Then, three sections follow in which we present the data analysis, delineate the study participants' information management practices, and discuss our findings. The paper concludes by summarising the empirical findings and highlighting future research directions.

2. Background

Prior research about information management in the workplace has, among other things, looked at e-mail use. It has been found that people perceive e-mail handling as one of the most stressful contacts with technology at work (Barley et.al., 2010). E-mail has become an integral part of everyday life and people need to be able to quickly recognise e-mails as not relevant, informative, or triggers for action. Failing to manage one's inbox for more than a day can lead to delays or mis-communication at work. When a response to an email is received later than expected, or not at all, it is unclear if the technology has failed, if the person is not responding for a reason, or if the person is truly unavailable (Sarbaugh-Thompson & Feldman, 1998). This ambiguity influences trust in the work place. Thus, the (email supported) information flow within an organization has important effects on the organizational processes of creating contacts, maintaining relationships, and gathering information for decision making (Feldman, 1987; Sarbaugh-Thompson & Feldman, 1998).

Recently, social networking technologies have further added to the constant frenzy of catching up with information and the need to keep in touch with people around the world. A recent study of Web 2.0 and its impact on business (Andriole, 2010) shows that the most popular applications are wikis, blogs and social networks (such as, e.g., Facebook, Twitter, and LinkedIn).

Knowledge workers are called to be up-to-date with information in their fields and enhance their knowledge on an everyday basis. Information overload has long been identified as a trigger for stress in the workplace (Novak, 1986), while today expressions such as "infomania" and "infoglut" are used to describe information overload as well as interruptions and distractions coming from the constant exposure to information. It has been suggested that knowledge workers need easy access to information through a single interface (Feldman, 2004) or software tools for filtering information. A general advice given to people in order to reduce information overflow is to use the technology itself more effectively by for example

using e-mail filters, stop e-mail notifications or use the mute button on mobile devices (Jarvenpaa and Lang, 2005, Dabbish and Kraut, 2006). However, these solutions are primarily looking to reduce the amount of information coming in rather than improve the practices used to manage information.

It is reported that in general little is done by organisations to tackle a problem as big as information overload (IEEE Spectrum, 2009). Moreover, there is still limited knowledge about workplace information management in the information age, and therefore, employees have to develop and apply their own practices for making sense of information, i.e., for acquiring, filtering, prioritising, organising, and analysing information and for being responsive to information overload.

In this paper, we propose a theoretical framework based on three approaches and investigate knowledge workers' practices for coping with information overload and managing information available in the workplace. We focus on a range of technologies. These technologies include the "more traditional" means of information exchange such as email and web pages, as well as emerging applications enabled by Web 2.0, such as social media and networking tools.

3. Theoretical framework

We conceptualise information management as double-edged in the sense that it encompasses practices (a) for coping with information overload as well as (b) for benefitting from the use of information (information empowerment). Moreover, we draw on different theoretical approaches to address information management from different perspectives.

How people create meaning from online information (Sense-making). Individuals search for and use information to make sense of their situation, and in the process they make sense of both the information and the situation (Solomon, 1997). Thus, sense-making involves interpreting circumstances to turn them into a situation that is meaningful and which can serve as a springboard for action (Weick et al., 2005).

Sense-making starts with the knowledge worker noticing and focusing on certain cues (i.e. information) that stand out among the many things that go on. This noticing is guided by the knowledge worker's mental models, expectations, intentions, and observed anomalies (i.e. deviations from expectations) as well as by other factors such as previously seen information or discussions with colleagues (Weick et al., 2005). It is to a large extent the person's

expectations, goals, priorities, and tasks at a given point in time that makes her notice and act in accordance with certain cues while ignoring others (see e.g., Choo, 1996; Solomon, 1997; Weick, 1995; Weick et al., 2005). In other words, expectations and intention strongly influences what kind of information the individual pay attention to and creates meaning from. Meaning is created by labelling and categorising information and events. This in turn serves to stabilise and organise experience and to indicate what constitutes appropriate action. Important features of the labels and categories are that they are locally and socially defined, and that they therefore have considerable plasticity, i.e. they can be adapted to changing goals, tasks, and contexts. Moreover, a central component of sense-making is verbal and written communication. Thus, sense-making is an activity that talks actions and events into existence and where people try to make sense of how other people make sense in order to communicate more efficiently with them (Weick et al., 2005).

In sum, sense-making occurs when, among a continuous flow of information and events, certain cues gets noticed, interpreted, and articulated using salient categories that points towards appropriate action.

How people interact with, and manage information available via Internet technologies, so as to make decisions (Decision-making). Humans are subject to bounded rationality since their cognitive abilities and capacity are limited and do not allow them to process all the information required to deal with complex situations. This, in turn implies that they have limited information processing abilities (Simon, 1955). In the decision process people have to cope with the information available in a specific situation (March, 1978). Internet technologies increase information availability, which in turn may empower, or impede the decision-maker. The information management practices are shaped by the individual's cognitive processes or intuitive approaches based on heuristics (Kahneman, 2003). The knowledge worker uses heuristics to reduce the cognitive effort required to deal with all the available information in the situation at hand. However, the use of heuristics may lead to bounded awareness (Chugh and Bazerman, 2007), i.e. it might make the knowledge worker ignore relevant, available information, e.g., information in one's email inbox, during specific tasks.

The use of heuristics to simplify information processing during specific tasks has been investigated by many researchers in different contexts. Most of these works were grounded in Tversky and Kahneman's (1974) seminal work on heuristics. Payne et al. (1993) describe

decision-making as an adaptive process influenced by characteristics of the individual, the social context, and the problem at hand. They underline the tradeoff between cognitive effort and accuracy as a main determinant of the choice of heuristics or other methods in the choice process.

The importance of cognitive effort in reasoning for a choice has been investigated by Gigerenzer and Goldstein (1996) who proposed that reasoning may take place in a fast and frugal way. Todd and Gigerenzer (2003) described four types of decision making that draw on several fast and frugal heuristics. The decision making types and the corresponding heuristics are supported by a large number of empirical studies (e.g., Gilovich et al., 2002, Goldstein and Gigerenzer, 2002). First, ignorance based decision-making rely on the lack of knowledge about the available options. It is mainly represented by the ‘recognition’ heuristic, where it is recognition of one option and not another that informs the decision (Goldstein and Gigerenzer, 2002). Second, one-reason decision making includes heuristics such as “take the best”, “take the last”, and “minimalist”. The three heuristics are based on the proven value of a cue, the recent usefulness of a cue, and the choice of a random cue, respectively (Todd and Gigerenzer, 2003). Third, decision making by elimination can take place when many options are available to categorise and evaluate (Tversky, 1972), and are mainly represented by the ‘categorization by elimination’ heuristic (Todd and Gigerenzer, 2003). Finally, satisficing heuristics are used in sequential search, which stops when the “aspiration level” is met in relation to a specific cue or attribute of the option (Bazerman, 2008). The satisficing heuristics have been recently proposed as a solution to the information overload problems encountered by knowledge workers with the advent of web 2.0 technologies (Bawden and Robinson, 2009).

These four types of decision making (i.e. ignorance based, one-reason, elimination, and satisficing) constitute an “adaptive toolbox” (Gigerenzer et al., 1999) of cognitive mechanisms that have been developed through learning and other evolution processes of the individual. The fast and frugal heuristics will be used in this study due to their simplicity in describing the knowledge worker’s choices during typical information management tasks conducted in the workplace.

How people maintain a balance between a focused mind and openness to emerging and contextual information (Mindfulness). Mindfulness is a state of mind where the individual shows openness to new information and different points of view while remaining aware of the

context and in control of the situation at hand (Langer, 1989). Being mindful as a knowledge worker demands a great deal of attention and self-awareness. It is the ability to flexibly direct attention on an ad-hoc basis always depending on the situation at hand in the specific context of work. Maintaining a mindful state of mind gives people the possibility to avoid a situation where information is either ignored, or misinterpreted with adverse effects for decision-making (Langer, 1989). Being mindful means being aware of the diversity of tasks coming your way but also being open to experiences which have not been planned or organised. Mindfulness is also about keeping a focused attention to the task at hand and performing one-thing-at-a-time in order to keep the concentration going while welcoming new inputs if they arrive.

To define mindfulness three types of attention have been identified: alerting, orienting, and conflict (Posner et.al., 2006). Alerting attention relates to our ability to be ready to take action or attend to a particular object. It does not require voluntary effort, it always present at a certain degree and can be affected by factors such as coffee, alcohol or fear. Orienting attention refers to our ability to voluntarily direct our attention to an object, while conflict attention reflects our ability to stay focused in the face of intruding distractions. A mindful state relates to a heighten ability to use conflict attention when too much stimulating information is present while being open to new information, i.e. to use orienting attention when needed. The ability to effectively use both types of attention can be trained through mindful practices where participants pay full attention to what is happening in the current moment with open curiosity (Smalley and Winston, 2010).

Having briefly described the three theoretical approaches used in this study, Figure 1 depicts our theoretical framework using a funnel metaphor. We use a simple case of information management, where the knowledge worker only has one task, in order to explain the framework. A knowledge worker always has a state of mind while performing a specific task. Mindfulness enables her to keep overview of all the relevant information, thus reducing the cognitive bias in accessing the necessary information for the task. In other words, if the knowledge worker is mindful she is able to pay attention to more information. Next, mindfulness enables her to focus on applying categories to decide on which information to work with and in what order. The last step is to use the information to perform the task, or to make a decision related to the task.

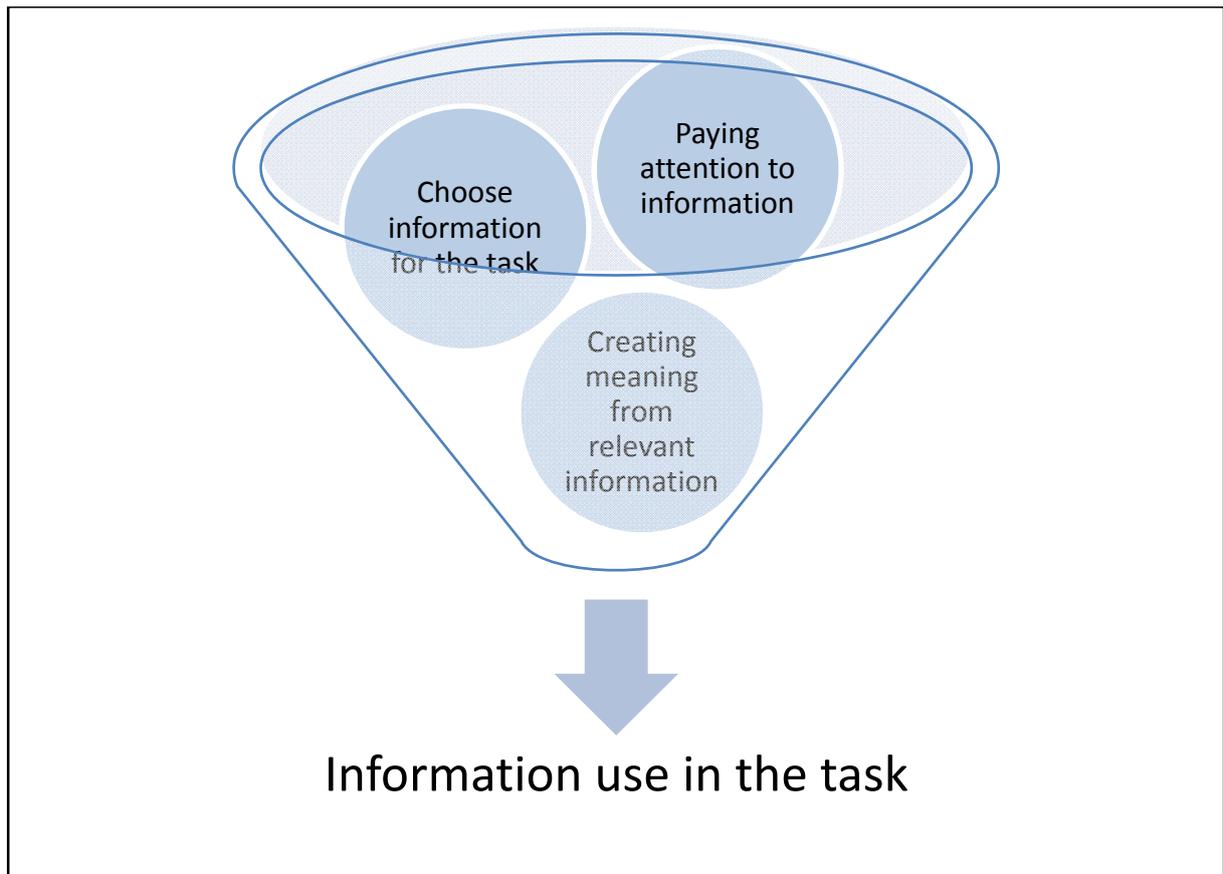


Figure 1: A funnel view of the theoretical framework

In practice, knowledge workers experience more complicated situations and multi-tasking is often required. However, in case of multi-tasking it is difficult for the knowledge worker to remain mindful (Hunter & Scherer, 2009).

4. Research Method

This research is based on qualitative data, which we have collected via diaries and analysed using the theoretical framework presented above.

Written diaries were chosen because they facilitate collection of data that is personal and reflective as the participants can think about and describe (i.e., make sense of) their information management practices in their own words when it is convenient for them (Creswell, 2003).

The study involved 7 participants from academia. We consider a university environment a relevant setting for this study as academic activities, such as teaching and research, relies heavily on the use of many information sources. Moreover, the characteristics of an academic

researcher and her work tasks fit well with the definition of a knowledge worker, i.e., an individual who is highly educated and employed to identify, analyse, and synthesise information within a specific field (see, e.g., Drucker, 2001). The participants were selected so that the view points of both genders (i.e. four females and three males) as well as different ages (from 28 - 62 years of age) and levels of academic experience were (i.e. Ph.D. students and senior researchers) were represented.

The study participants were asked to keep a diary of their information management activities for five work days. They were provided with an electronic diary template that explained the purpose of the study, and which contained clearly marked entry points for each of the five days. The focus on the participants' use of information management practices on a day to day basis was inspired by Elsbach and Hargadon (2006). Elsbach and Hargadon (2006) suggest that the creativity and results of today's chronically overworked professionals can be improved by focusing on the design of work days (rather than jobs). Moreover, by collecting data about the information management practices that the study participants used over the course of several days we are able to identify unique instances as well as patterns, in each diary as well as across the data material.

For each of the five days the diary template also contained entry points for three pre-specified themes: email management, choice of communication media, and information search. These three themes were identified in a preliminary study, in which the three authors of this paper kept on unstructured diary for three days. Analysis of the unstructured diary entries revealed that the performed information management activities could be categorised according to these themes. This insight was compared with extant research and we found a high degree of overlap in the three identified themes and the themes covered by the literature about information management in the workplace (see section two). Together the findings from the preliminary study and insights from extant research have informed the design of the diary template.

As the diaries were structured around the three themes of email management, media choice, and information search the collected data was already organised in a way that allowed for thematic analysis. Following Miles and Huberman (1999), the diary entries were coded independently by the three paper authors. The coding scheme was derived from the conceptual framework and covered codes related to different types of attention, the creation of meaning, and decision-making heuristics. The results of the coding process were jointly

discussed, differences (of which there were not many) were reconciled, and illustrative quotes for inclusion in the reporting of findings (see section 5 below) were selected. The included quotes were selected to show the diversity of practices used and to highlight patterns in the participants' use of practices.

5. Information Management Practices in academic environments

An academic, as an example of a knowledge worker, has to juggle between research work, teaching of known and new topics e.g., emerging themes within a specific field, as well as managerial and administrative work. The metaphor of dance has previously been used to conceptualise the steps of knowledge work that involves qualitative data i.e., information (warm-up, workout/exercises, cool-down) (Janesick, 1998). Building on this metaphor, the everyday activities of a knowledge worker include a lot of “dance” moves where she has to use elasticity and flexibility of mind if she wants to perform to high standards.

We analyse the information management practices of the participants in the study by focusing on three typical task categories, namely email management, communication media choice and information search. In particular, we focus on the participants' choices of how to manage and answer incoming emails, how to communicate with colleagues in the presence of a wide variety of communication media and how to find relevant information for a task through the use of internet technologies. These choices may be subject to different types of attention and sense-making strategies that manifest through the use of fast and frugal heuristics.

5.1. E-mail management

The study participants report that email management does take up much of their time and that they check their email first thing when they arrive at work in the morning. Thus, email management is an important task in itself, and not just one whereby information is sought for other tasks.

“Started ca 9 am. Will probably spend all day (when not in meetings) going through the inbox and replying to mail. I am going through mails in order of (perceived) importance.”
(Male, 51)

Email management involves high cognitive effort from the knowledge worker. Therefore, prioritisation of emails is needed. The study participants prioritise using a variety of information management practices, including more or less fixed categorisation schemes as

well as heuristics. The participants' diaries indicate that especially 'categorization by elimination' heuristics are used for interpreting and prioritising incoming emails and how to respond to them. Some participants have created and implemented their own categories for email prioritisation.

"I have created some folders and a filter for each of them in my mail box. So, I check first the ones from my supervisor, my colleagues, [other] contact persons...and at the end the spam emails related to my work...". (Male, 28)

Others indicated a less structured approach to email management where they use 'categorization by elimination' based on broad-level categories with high plasticity. The applied categorisation scheme seems to distinguish between "important" and unimportant" information as well as between emails that are "quick" and "time consuming" to handle.

"What I usually do is read (or better scan) all incoming emails quickly. Some of the emails I delete right away so they do not block my inbox (e.g. from colleagues saying that we meet for lunch in 5 min), others that are important but I cannot answer right away (either because information is missing or because it would take too much time at the spot) I put on 'unread' again. Others, which ask for a quick and short reply I usually answer right away". (Female, 28a)

Orienting attention is used here in order to attend to "important" information while eliminating "unimportant" parts. Quick elimination of unimportant information represents a conscious effort to exercise conflict attention by reducing the amount of information available at any time.

Finally, some respondents combine 'categorization by elimination' and 'satisficing' heuristics to prioritise incoming emails. The categorisation scheme used in the example below shows a clear people-orientation as a focus on who the sender is drives the interpretation and prioritisation. Moreover, the expected time to complete a responds is taken into account. Use of the satisficing heuristic is illustrated by the respondent's explanation that for some emails a (perceived) satisfactory result had been reached from interpreting and making sense of the content of the subject field rather than reading the whole email.

"Reading email is the first thing that I did in the morning at 09:00. Then every time I get a new email I get a notification and I check my inbox every time I get a new email. First I see who send it...First, I opened the supervisors email...Then I marked all of the emails from

[some of] my colleagues as read because I could get the meaning from the subject. Last, I opened the email from [a particular] colleague...I opened this email last because I knew that probably more work was involved". (Female, 28b)

In summary, the above examples illustrate that the study participants perceive email management as an important task. Moreover, there seems to be a pattern in the way they carry out email management. First, they do a quick scan to achieve overview and deal with or delete unimportant or easily understandable information immediately. Second, a more systematic handling of the remaining emails are conducted based on perceived importance (i.e. using a very plastic category), a people-orientation (i.e. who is the sender), and the amount of time and work required to complete a response. In other words, email management is performed in several sense-making cycles where different categorisation schemes and 'categorization by elimination' heuristics are used in each cycle.

5.2. Choice of communication media

Knowledge workers have a wide variety of communication media available to them to exchange information with colleagues. Communication media vary from face-to-face meetings, phone, and email to chat online through instant messaging and use of social networks to exchange information.

The participants seem to prefer face-to face communication over other communication means when the information is complicated and clarifications are needed. Previous satisfactory experiences with this type of communication are used as cues, indicating the use of 'take the best' heuristic.

"Today, I had a meeting in my office. My [research] partner decided to visit me, as he had an important topic to discuss. He came, as the communication via Email had not the result that he wanted. Finally the meeting really created a better result than before. So it was a good choice."(Female, 33)

This case demonstrates a clear decision to use orienting attention in order to deal with an important matter face-to-face. Any other source of information is eliminated and there is only one object of attention, namely the other person in the meeting. The focused attention applied during the face-to-face interaction allowed the interaction partners to arrive at a better solution. Thus, what the research partner had initially perceived as an unsatisfactory outcome was turned into a shared sense of achievement.

Phone calls are used for prompt exchange of information, based on the “take the best” heuristic and to ensure that the interaction partner is fully oriented and focused during the conversation.

“I also used the phone...It was an urgent matter so I wanted an immediate response instead of waiting to get a reply via email.” (Female, 33)

In the above examples the study participants describe situations in which one particular type of media is intuitively or immediately favoured. However, in some cases respondents consciously consider different communication means in order to decide which one that will satisfy them with regard to the most important cue for the specific task. Thus, they use ‘satisficing’ heuristics. In the quote below email is for example considered satisfactory because it allows the knowledge worker to send a formal meeting invitation, thereby indicating to the other that the interaction is work-related and important.

“I had to arrange a meeting with a colleague of mine. I could contact her by phone, email, work chat, and directly. I chose to contact her by email because I think it is a bit more formal and the email also supports meeting invitations which is placed in my calendar”. (Female, 28b)

In other cases, intention might drive the choice of media. For example, a broadly defined intention to “know more” or a more specific intention to steer an interaction partner’s attention and interpretation of information in the desired direction. Participants indicate the use of the “take the last” heuristic to choose media with recently proven usefulness.

“Today I was reading an article about a theory that I was not familiar with and I wanted to know more. So I googled it first and I read a bit on Wikipedia then I googled it again in google scholar for more articles on the subject”. (Female, 28b)

In some cases participants make “strategic” choices of media to achieve a specific objective, which implies the use of higher cognitive effort than a heuristic during the choice process.

“I wanted to ask an ex-colleague about her new position that was relevant to my research. So I... send her an email from my Linked in account. I could have called her or...send her an email from my company email. But I wanted her to check my profile in Linked in so she could see that my work was relevant to hers.” (Female, 28b)

In sum, the above examples show that the participants are not ignorant about the communication media available. Habitual patterns based on satisfactory previous choices are prominent. The choice of communication media is mainly based on ‘one-reason’ decision making heuristics. However, sometimes participants seem to be more strategic in their choice of communications media in that they compare different alternatives to find the most appropriate one for the task at hand. Moreover, interpretations of situations and outcomes as well as considerations about how best to approach people to ensure their attention to urgent matters and to indicate intentions drive the choice of media.

5.3.Information search

Information search on the Internet can be a laborious task due to the huge amount of information available to the knowledge worker. However, it seems that the study participants rely on specific practices that help them reduce the time and cognitive effort required to obtain desired results from information search. The participants indicate the use of most of the fast and frugal heuristics categories in their information search activities.

The most prominent type of decision making was based on the one-reason decision making heuristics. Thus, in line with the “take the best” heuristic participants explain that a particular search engine was highly appreciated due to the proven usefulness and validity of its results.

“I also searched...on Google. I used Google, as the results are usually very good.” (Female, 33)

The participants also focus on choices that had recently proven to be useful, i.e. they use the “take the last” heuristic.

“I used onlinedictionary.com to find out the meaning of a word that I could not understand. I have used in the past the same source and I have been satisfied”. (Female, 28b)

Interestingly, choices are sometimes made through ignorance-based decision making, where it is familiarity with one option combined with a lack of knowledge about alternatives that drives the decision. The quote below illustrates the use of the ‘recognition’ heuristic.

“I used Leo.org to translate a few words. I use Leo, because I am used to it. I don't know if there is a better Service to translate one word...I never searched for another service”. (Female, 33)

When conducting sequential search the participants narrow the information search activities as much as possible, and the use of the ‘satisficing’ heuristic is very common. In other words, search is stopped as soon as a satisfactory result has been reached. For example, in case of travelling information, one participant described:

“I searched today for a hotel for a conference in the Web. I used the recommendations of the Conference Website and also checked the recommendations on expedia.de. I have chosen expedia.de as I booked... a hotel [there before]”. (Female, 33)

With regard to search for content that provides new knowledge different practices are described. For example, when search is driven by a specific task the participants indicate the use of ‘categorization by elimination’ heuristics to reduce the amount of information that has to be interpreted.

“I prepared for a course that I will give next week. In order to learn more about the topic and get background information I searched Google and Goolge scholar...I pretty much used the first page of the Google results...” (Female, 28a)

Alternatively, when search does not occur due to a specific task, a choice to pursue a random cue (i.e. to use the minimalist heuristic) may lead to serendipitous discovery.

“Eventually I stumbled on...information...pushed to me from an IT news agency with a mentioning of a new Norwegian travelers application. I visited the website and got the “app” and played with the app to learn about its functions and facilities. They were quite impressive. Had I not “seen” the note in the media above and seen a link to some ideas I have been entertaining for some time I would not have “clicked” on the reference to yet another application and thus have failed to notice this major step in offering new facilities in an application”. (Male, 62)

The quote describes a situation where the respondent became alert and immediately attended to information that emerged unexpectedly but which he recognised as in line with a research interest of his. Thus, he was able to notice the information, quickly categorise it as relevant for him, and pursue it to learn more. The outcome was a feeling of information empowerment, even though the respondent is aware that the information emerged more or less randomly and that he easily could have been overlooked it in the ongoing stream of incoming information.

“After the meetings around noon time and at lunch we went back to continue working using our systems to approach people, and to visit sites for further information, and extracting notes and information from the iPad and a desktop computer. We exchanged files using e-mail. We mixed information retrieval/search from our respective storage (hard disks) and from information in list of contacts, calendar information and search on the internet.” (Male, 62)

The quote describes a situation where the participants work with multiple sources of information and communication tools, while at the same time being engaged in face-to-face interaction with each other. We cannot see from the diary excerpt if the meeting participants were able to juggle these many information sources in an unproblematic way, but both orienting and conflict attention would need to be used here in order to avoid information overload and confusion. Interestingly, the quote also illustrates that much attention is paid to finding information about people and considering how to approach them. In other words, a people-orientation is demonstrated.

In sum, the knowledge workers in our study use a wide variety of fast and frugal heuristics to facilitate information search. In particular they use information management practices that allow them to quickly reduce the amount of information that needs attention and interpretation. This selective attention to specific information may reduce the accuracy of information retrieval and use and it can therefore have adverse effects on the corresponding task. However, it also reduces the time and cognitive effort required for information search, which is positive and even potentially empowering for the knowledge worker. Thus, interestingly, the data shows that the study participants’ “reductionist” approach to information search leads to results that they consider satisfactory.

6. Identifying the Information Management Practices

The previous section offered examples from the life of seven academics. Based on the analysis different information management practices can be identified with regard to email management, media choice and information search. Table 1 provides an overview of practices used. These practices are organised in relation to their ability to help the knowledge worker cope with information overload or experience information empowerment.

Table 1: Overview of Information Management Practices

Tasks	Coping with information overload	Enabling information empowerment
Email management	-Elimination and prioritisation using categorisation schemes. -Categorisation schemes cover perceived importance of topic and/or sender as well as time and amount of work required.	-Context aware email management based on several sense-making cycles.
Choice of communication media	-Communication media are chosen based on habitual patterns and the use of heuristics.	-Use of different media to communicate with contacts based on the complexity and/or urgency of the message as well as the person involved.
Information search	-Simple cues (e.g. proven usefulness, recent experience and recognition) are used to decide that a satisfactory result has been achieved and that search can be stopped.	-Serendipitous findings (e.g. links from unexpected sources). -Quick access to relevant information about unknown topics (e.g. Google scholar).

Having presented an overview of participants' information management practices in relation to specific tasks at the workplace, the next section describes some reflections on the findings.

7. Discussion

In this study we have explored how knowledge workers cope with information overload and become empowered in the information abundant work environments enabled by Internet technologies. We focus on academics and typical tasks of their everyday work. Our analysis of the empirical data shows that the academics have developed their own ways of dealing with information overload and use information to empower them during specific tasks. Thus,

the knowledge workers in this study are not amateurs, overwhelmed by the abundance of information. However, there is no evidence that they are professionals in managing information either. It seems that their practices are sustainable and allow them to complete specific tasks by avoiding the cognitive burden of analysing all the information available. Instead they select specific information based on a set of simple practices.

It is difficult – both for the individual involved as well as from a research perspective - to identify the level of alerting attention in an individual as this depends on the time of the day they perform a task and their physical and mental health. However, their orienting and conflicting attention can be interpreted through their actions towards incoming information. Our data shows that people in the workplace are aware of the vast amount of information and communication choices that are available to them and that they therefore interpret the situation in which they find themselves to make choices and deliberately use their ability to focus when it is required. For example they will drop everything to attend to an important face-to-face meeting and they will shift from scanning through e-mails to concentrating on one that needs their full attention.

Our data also shows that information is selected through the use of simple heuristics that allow for fast and frugal cognitive processes (Todd and Gigerenzer, 2003). Choices of information sources, communication media and decisions about how to answer emails are based on a single cue. High validity, recent history, and even randomness of the cue lead to the use of fast and frugal heuristics. The participants seem to choose satisficing instead of optimising practices of information management. Whether this decision is conscious or not and how it influences the quality and completion of the corresponding task are questions that remain open at this stage. Obviously the knowledge worker has to strike a balance between the cognitive effort required to process more information and the accuracy needed for a specific task, as well as with regard to the time and other physical constraints involved. The satisficing practices seem to address the information overload problem, but they may not be the most appropriate to enable information empowerment.

The participants' use of information management practices, which allow them to perform and complete specific tasks at workplace, indicates that they are not amateurs in this activity. However, the question of how far they should evolve in developing “professional” practices remains open. Would they be in a better position to complete their tasks if they used more rational information management practices? For example, would other approaches to email management (i.e. use of other email categorisation schemes) generate better results and interpersonal relationships at work? And would spending more time in finding information

about a new topic rather than simply choosing and browsing the first listed result of a Google search improve the task at hand? Those questions cannot be answered in a straightforward way, since the answers are highly dependent on the specific task. However, increasing the knowledge workers self-awareness of her own information management practices would allow her to evaluate them and consider changes if necessary. This would empower the knowledge worker by strengthening her position in the different information abundant environments' where choices need to be made in order to complete a specific task.

When it comes to work-related stress it has been reported that people need to develop self-management practices in order to improve productivity, and mindfulness has been promoted as way to develop such practices (Hunter and Scherer, 2009; Vilardaga, et. al., 2011). Mindfulness training can be used to help people be more effective with their existing practices in directing attention skilfully. There are different techniques that can be used to cultivate attention such as mindful sitting, mindful walking, or mindful exercising; these techniques have been used extensively to eliminate stress and promote well-being (Kabat-Zinn, 2005). As people today spend a large amount of time at work and deal with much information on an everyday basis, finding ways to help them be more effective in using and improving their information management practices through self-awareness and skilful directing of attention seems like a necessity.

8. Conclusions and Future Research

This study has explored the information management practices of academics as an example of how knowledge workers deal with the abundance of information available through Internet technologies in the workplace. We found evidence that academics do not act as mere amateurs, overwhelmed by the information. Instead they have developed their own sustainable practices for managing information related to specific tasks. Thus, our data shows that they use satisficing rather than optimising practices. While the study participants perceive these practices to be adequate, we propose that training that aim to cultivate attention and generate self-awareness about the specific practices used can contribute positively to further information empowerment of these knowledge workers.

Our findings are based on an exploratory study of a small number of knowledge workers and as such it does not allow for generalisations of the information management practices. Besides, we used self-reported diary data. This data could have been enriched with observations and interviews which would allow us to validate the diary data. Finally, in the

data collection we did not ask specific questions about information overload and empowerment. We identify these situations from the participants' descriptions of the specific tasks. We also did not ask them to describe their state of mind or the amount of attention they were devoting to a task as these would be challenging aspects to describe un-aided in a written diary. Instead, we infer this information from their description of the specific tasks.

This exploratory study proposes a theoretical framework for investigating information management practices at the workplace. Future research should focus on knowledge workers in different settings. Moreover, studies that combine different research methods such as diaries, observations, and interviews are warranted to refine the theoretical framework and provide generalisable results.

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