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Knowledge Workers' Time Management As Sociomaterial Practice

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Abstract

Motivated by the apparent problems many knowledge workers have with managing their time effectively and the tremendous costs to individuals and organizations arising from these problems, we investigated the time management practices of five knowledge workers and analysed the processes and relationships linking these practices with related time management strategies and artefacts. Building on the conceptual foundations of the sociomaterial practice lens, we were able to identify three general objectives pursued with time management practices: remembering tasks, deciding what to do next, and maintaining a well-organized work place. In total we found 14 different practices for time management and could show the importance of both human and material agency in constituting the practices we observed. Furthermore we found practices to be highly interrelated. Similarly, previous practices also have a strong influence on current ones. Thus, changes in one practice will likely impact other practices as well and the actual effects are influenced by personal history and will be hard to predict in advance due to the emergent nature of the change.

Keywords: time management, sociomateriality, practices, interpretive case study.

1 Introduction

Today, many people experience increasing time pressure at work resulting in high levels of stress and strain (Jex and Elacqua, 1999). In general an increased pace of life (Garhammer, 2002) can be observed, shown in doing things faster, contracting time expenditure (e.g. eat faster, sleep less), and compressing actions (e.g. making a phone call while having lunch). According to Orlikowski and Yates (2002), the temporal dimension of work has become more important because of expanding global competition and increased demands for immediate availability of products and services. Companies respond to this threat by switching coordination mechanisms from top-down decrees to increasingly autonomous work at the 'front lines' coordinated through shared values as well as common processes and technology (Kanter, 2008). While greater autonomy with respect to work related decisions *can* result in higher levels of work satisfaction (Claessens et al., 2004), the accompanying increase in workload, time pressure and longer hours may as easily lead to stress and reduced effectiveness making people feel less able to cope with and control their workloads, their time and their lives (Green and Skinner, 2005). This is especially true for knowledge work with its focus on non-routine cognitive tasks and high degree of self-determination (Kidd, 1994). Associated consequences and costs both to individuals as well as organizations are tremendous. Individuals suffer from impaired health, damaged relationships and poor quality of life (Davis, 1999). For organizations consequences include impaired employees' performance (Jex and Elacqua, 1999), high turnover, absenteeism and decline in customer satisfaction (Cox, 2000; Green and Skinner, 2005). Thus, the ability of knowledge workers to manage their available time effectively and as a result "work smarter [instead of] harder" (Lakein, 1989 p. vii) becomes increasingly important.

Current research basically proposes two ways of making knowledge workers' way of working 'smarter'. One camp suggests that individuals should adapt their work practices and include time management strategies, like setting goals and priorities or making lists (e.g. Claessens et al., 2004; Macan, 1994). Other researchers highlight the role of artefacts in supporting existing work practices and mitigating specific problems related to management of time, like multitasking and frequent interruptions (e.g. Bellotti et al., 2005; Camacho et al., 2006). Both research streams made great progress in identifying strategies for time management, understanding their effects and finding ways to support work with artefacts. While this knowledge is important and offers a valuable basis for improving knowledge workers' daily work life, the mere availability of strategies and artefacts does not necessarily lead to a sustainable transformation of people's way of working, i.e. their actual work practices. Everyone who tried to sustainably implement one of the many available time management strategies (e.g. Allen, 2003) or software tools (e.g. Remember the Milk, Things, Wunderlist, to name just a few) will most likely agree. Studies on the effectiveness of time management training came to similar conclusions, as training was found to be only partially capable of changing time management behaviour (e.g. Macan, 1994). The problem is that the desired outcomes, like job satisfaction and well-being, can only be achieved through changes in everyday work practices (Feldman and Orlikowski, 2011). Building on the conceptual foundations of the sociomaterial practice lens (Orlikowski and Scott, 2008), the present study aims at contributing to the literature on time management by shedding light on the constitution of time management practices as well as the processes and relationships linking them with related strategies and artefacts and thus providing a basis for a better understanding of how to improve knowledge workers' management of time.

The remainder of the paper is structured as follows. Section two gives an overview of the related work covering time management artefacts and strategies as well as introduces relevant concepts of the sociomaterial practice perspective. The third section describes the research method. Section four provides an overview of the cases and presents the sociomaterial work practices identified in the field study. The constitution of these time management practices and the processes and relationships linking them with related strategies and artefacts are discussed in section five. The paper concludes with a summary of the findings and a discussion of the contributions to research and practice.

2   Foundations

2.1   Time management artefacts and strategies

Researchers concerned with the development or improvement of software artefacts for supporting time management, so far basically identified three main problems: information fragmentation (Bergman et al., 2006), information overload (Janssen and Poot, 2006), and continuous task switching (González and Mark, 2005). To reduce productivity loss due to these problems they proposed systems supporting users either by fostering integration or automating some aspects of personal organizing and planning. Systems extending the operating system (e.g. Czerwinski et al., 2004) were built to overcome problems associated with the data and/or application-centric computing paradigm. Similar considerations resulted in systems for organizing information around projects (e.g. Bergman et al., 2006) and working spheres (e.g. Camacho et al., 2006). Other researchers studied task management capabilities of specific tools, email clients in most cases (e.g. Bellotti et al., 2005). As necessity to explicitly define tasks and task context was found to be a major adoption barrier for most users, a further stream of research attempted to address this problem with systems for automatic elicitation of task context from user interactions (e.g. Rattenbury and Canny, 2007). Being guided by the idea of user-centred design these studies are based on the assumption that people are constraint by currently available technology and thus changes in technology will lead to an improvement in work practices, provided the implemented changes remove the identified constraints. Consequently, these studies typically focus on evaluation of the proposed technology designs in terms of requirements fit, and do not investigate the appropriation of technology by users in everyday life.

On the other hand researchers interested in time management strategies focus on the effectiveness of training programs in improving people's work practices and the question if these changes translate into desirable outcomes like job satisfaction or well-being at work (e.g. Van Eerde, 2003). The role of artefact support is only considered in terms of the accompanying practices, e.g. list making, without reference to the characteristics of the artefact used to make the list. Process models of time management propose that perceived control of time is crucial here as it mediates time management behaviour on the one hand and indicators of job satisfaction and well-being on the other hand (e.g. Macan, 1994). Perceived control of time is characterized by an employee's perception of having enough time to finish one's work and the ability to meet one's deadlines, keep schedules and plans in mind, and to procrastinate little (Häfner and Stock, 2010). Research has shown that perceived control of time is a meaningful predictor of job satisfaction and well-being (e.g. Adams and Jex, 1999). Furthermore, it is a well-established result that time management behaviour is related to perceived control of time (e.g. Jex and Elacqua, 1999). Yet, studies on the effectiveness of time management training came to the conclusion that it is only partially capable of changing time management behaviour (Green and Skinner, 2005; Macan, 1994). For example training was shown to affect only one out of three sets of time management behaviour, i.e. setting goals and priorities. The other two – mechanics of time management (like making lists and taking notes) and preference for organization – were basically unaffected by the respective trainings even though the trainings were designed to improve both (Macan, 1994).

2.2   Sociomaterial practice perspective

In our attempt to better understand the processes and relationships linking time management strategies and artefacts with everyday action, we found a sociomaterial practice perspective (Orlikowski and Scott, 2008) useful. In summary, this perspective holds that social life is produced and reproduced in everyday, situated action and that this local emergence includes the material (e.g. artefacts) as well as social structures and processes (Feldman and Orlikowski, 2011).This perspective has two implications for how we theorize and study time management practices. First, in rejecting the human/artefact

dualism the perspective reminds us of the mutual constitution of the material and the social, i.e. the material and the social both have agency, but this agency is never known in advance and is only revealed in practice (Wagner et al., 2010). Orlikowski & Scott (2008) use the notion of a sociomaterial assemblage to capture this aspect. Second, the concept of relationships of mutual constitution stresses that no phenomenon can be taken to be independent of other phenomena and thus exist only in relation with each other (Feldman and Orlikowski, 2011). This implies that relationships between humans and artefacts are never fixed. Instead, the sociomaterial assemblage emerges from practice and defines how to practice (Wagner et al. 2010). Feldman and Pentland (2003) distinguish two aspects of practices, the performative aspect "embodies the specific actions, by specific people, at specific times and places" (p. 94), while the ostensive aspect refers to the "abstract, generalized idea" (p. 101) of a practice. As the discussion of current research above shows, the ostensive aspect of time management is well understood by now, i.e. we know how knowledge workers should behave in order to improve their perceived control of time and which artefact designs can support them. Yet, little is known about the performative aspect and the relationship between both. Our field study aims at advancing understanding in this area.

3　Research Design

Being interested in the performative aspects of knowledge workers' time management, we found the interpretive case study methodology in its hermeneutic version (e.g. Sarker and Lee, 2006) most applicable to guide the collection and analysis of data. That is we used texts reflecting the subjects' experiences with time management strategies and artefacts to develop a second-order theoretical understanding of the phenomenon (Sarker et al., 2006). Specifically, we applied the concept of the hermeneutic circle (Klein and Myers, 1999) to examine and make sense of our data.

3.1　Data collection

Our empirical material consisted of structured and semi-structured interviews supplemented with participant observation and artefacts (i.e. screenshots and photographs of a variety of digital and non-digital materials used for time management purposes). All interviews were recorded and transcribed. Interviews were conducted with five experienced knowledge workers each chosen to represent one of the typical or a specifically mixed case in terms of the knowledge worker types identified by Kidd (1994). Our rational for this sampling strategy was that, in line with prior research (Bondarenko and Janssen, 2005; Kidd, 1994), we expected work practices to significantly differ with the type of knowledge work primarily performed by our participants. Assignment to each category was based on self-classification (adapted from Bondarenko and Janssen, 2005) and general information about the participants current jobs, both collected during a separate pre-interviews conducted as 30 minute structured interviews by phone. The on-site interviews were conducted in much more depth, and typically lasted between one and two hours. They attempted to capture facts and emotional responses of the interviewee to different aspects of time management, and to explore meanings jointly with the interviewee (Sarker et al., 2006). Interview prompts (Young, 2008) instead of questions were used to, provide the intended focus, while also offering the required flexibility to adjust to the interview situation and keep the interview in an open manner in which it was easy for participants to stay in narrative mode. Interviews were centred on examples people took from their latest or current work life. Each interview started with a primarily interviewee guided tour on daily and weekly time management practices. During these tours topics, like handling of interruptions, parallel projects, and problems with tool support were initially discussed. The second part of the interview focused on one or two larger tasks and how people integrated outcomes and actions related to tasks in their daily planning. Finally, we included several debriefing questions (Charmaz, 2006) asking participants to highlight their most important subjects and significant changes related to their time management practices they perceived in comparison to the last position they held.

3.2   Data analysis

As mentioned above, we used the concept of the hermeneutic circle to make sense of our data. The hermeneutic circle is a device of mind (Sarker and Lee, 2006) that allows the reader of texts (in this case our data) to comprehend the parts in terms of the whole and vice versa. Starting with an explicit articulation of the initial (pre-)understanding, the idea is to carefully read the text "looking for any apparent absurdities" (Sarker and Lee, 2006 p. 133) or contradictions. Facing such absurdities the reader/researcher then "asks herself how a sensible person could have [expressed] them" (Lee, 1991 p. 348). "When the researcher comes across a plausible answer (however, tentative it might be)" (Sarker and Lee, 2006 p. 133), this new understanding may also change the meanings of other parts of the text, ones previously thought to have been understood. In applying the concept of the hermeneutic circle for our analysis we were guided by the logic of constant comparative analysis to identify initial concepts, to link this evolving set of concepts to higher level categories, and then to identify potential linkages between the categories as appropriate (Sarker et al., 2012). Implicitly, the constant comparative process involved data triangulation across participants, knowledge work types and data sources (Patton, 1990). In line with the application of the hermeneutic circle by Sarker and Lee (2006) we discontinued our iteration through the circle once we were satisfied with our latest interpretation, and did not face any absurdities any longer, while still recognizing that "further passes through the hermeneutic circle can result in an improved understanding" (Sarker and Lee, 2006 p. 134).

4   Findings

Before discussing the relationships and processes linking time management artefacts, strategies and practices, we first need to identify and describe the repeated patterns, i.e. work practices, in our participants' everyday way of coping with time management issues. Table 1 gives an overview of the five cases we investigated. While all our participants employed very different approaches with different results in terms of perceived control of time. Closer examination involving several iterations through the hermeneutic circle revealed three general objectives our participants pursued with their time management practices: remembering tasks, deciding what to do next, and maintaining a well-organized work place.

4.1   Remembering tasks

Sara successfully applies two basic principles for remembering tasks: noting down every task that comes to her mind or is addressed to her, and keeping things only at one specific location. For note taking, e.g. during a phone call or when she becomes aware of a task not yet recorded, and as short term reminder she uses a college block. Doing things at the right time is a core requirement in her job. For this reason, the reminder feature of Microsoft Outlook tasks is an important means to automate a just in time trigger for very important tasks or things that cannot be started before a certain date as she explains: "*I need something, that flashes and tells me 'Do that!'. And I tell the thing 'Done'*". We found Sara to be successful in using these reminders due to two strategies she employs. First, she uses a special recording technique for smaller, yet important tasks. The reminder contains a brief and very specific description, e.g. *"Call Idstein and inform them about Meyer and Heinrich",* by which she can cognitively access the needed context information. Second, for bigger tasks she uses the electronic reminder (and the keywords on her college block) as a trigger for creating a folder for keeping track of the respective task and starts collecting printouts with relevant task details there. *Gabriele* records all tasks that either need to be postponed because of their size or the current work situation or that need to be processed by someone else. Her personal list of all open actions is based on the list feature of Microsoft Word which she uses for recording and, if needed, scheduling by adding a deadline within the task description. To prevent overloading of her task list, she uses reminders for regular tasks she then adds to her work list when triggered by the corresponding Microsoft Outlook reminder.

Case	Job description	Key tasks
Sara	Executive assistant to managing director	- travel and meeting organization, manage incoming email of her boss and related actions - event organisation and projects like relocation (mainly defined and outlined by others)
Gabriele	Executive chairman and head of social institution	- negotiate care rates, legal representation of clients, strategic development of the organization - personnel management and administration - planning and organizing of larger projects, e.g. organization of removals, long-term renovation
Gisela	Social worker and leading counsellor of a youth organization	- functional coordination of all permanent staff - annual planning, cooperation with public administration and partners, public relations, member recruitment - organize regular and spontaneous activities as well as larger events like annual summer youth camps
Dagmar	Radio journalist (political correspondent, local reporter)	- attend regular and expected appointments, like press conferences of parliamentary groups, plenary sessions or minister visits - report on all topics of the state that are of general interest - prepare audio material for the editorial team of the main news
Pierre	Senior software developer	- take care of the integration of service processes across two business application components of a new enterprise resource planning system - maintenance of previous releases and new developments in the current release; need to be handled with priority over new developments - support the local product management team and the colleagues abroad

Table 1.   Summary of the cases

While Sara and Gabriele apply the general principle of recording all pending tasks, *Gisela* considers flexibility in managing and planning an important means to gain control over multiple events and tasks, and thus prefers to write down only crucial tasks and appointments. Having current plans constantly in her mind, she states, is a way to cope with a fast changing environment, which she complements with a set of tools and practices for keeping all crucial tasks and appointments close at hand. Both appointments and crucial tasks are recorded in her smart phone, usually using only a few keywords, like "youth camp". Yet, as opposed to the other participants, Gisela prefers to schedule her tasks, using the due date as an indicator when she intends to work on the respective issue. *Dagmar*, again similar to Sara and Gabriele, yet with focus on events instead of tasks, sees writing down all relevant information as crucial for her time management. Whenever the current situation does not require her full attention she enters upcoming events into her electronic calendar using the monthly view. To integrate individual events into a complete view for personal planning, Dagmar uses the header and detail fields to record event data like topic outline, location. Only for occasional short term task request addressed by colleagues in the daily phone conference she still uses a college block. Finally, *Pierre* applies a dual strategy. In his project work noting down all task and related information is key for his personal time management as well as in cooperation with others. He notes down all action items and task details for him and his co-workers in a remotely accessible document he calls "working document". He updates this Word document in preparation of all meetings, marking the status of action items and adding new information if required. On the other hand for maintenance tasks he does not create a personal list, but relies on the enterprise help desk system.

In summary, we found five partially interrelated sociomaterial practices for remembering tasks. Several participants used a *logfile* (1) to capture incoming task in chronologic order, also using these records as short-term task list. Sara and Dagmar used a college block for this purpose, while a similar use of other artefacts, like an enterprise help desk system (Pierre), was also observed. Dagmar and

Gabriele complemented this practice with a *complete list* (2) where they bundle representations of all activities they could not attend in the short run, while keeping detailed information at a separate location. Gabriele maintains a Word list of all current tasks, while Dagmar maintains a complete overview of upcoming events in her calendar. In contrast, others prefer to keep *to-dos together with task details* (3), thus allowing direct access of the details, however also limiting their ability to immediately gain an overview of all pending tasks. Sara collects all details of her tasks in separate plastic folders, while Pierre includes action items in working documents. Yet another way of dealing with this issue is to *record only crucial tasks* (4), keeping less pressing or important issues in mind (Gisela). Furthermore *electronic reminders* (5) where used to trigger task execution (Sara, Gisela) or reintegration with other practices (like maintaining a complete list: Gabriele) at specific dates or times.

4.2   Deciding what to do next

Every morning *Sara* performs a review of her current responsibilities in which she goes through all appointments, tasks, related action items, and Microsoft Outlook reminders. This includes checking her college block and all plastic folders assembled on her desk. Based on this collection she creates a hand-written daily extract of next actions that helps her focusing primarily on the most important tasks. In contrast, *Gabriele* basically relies on her Word list for deciding what to do, with the order of items indicating their importance and/or urgency. As she has all her currently relevant tasks and related information (e.g. deadlines) on her Word list, she can easily decide on her next actions based on the current situation and adapt plans to changing circumstances by updating the order of list items. In addition Gabriele performs a review of her work day in the evening and, if necessary, updates her Word list, e.g. if she forgot to add or remove an item during the day. As already mentioned, *Gisela* prefers to keep her current plans constantly in her mind to be able to cope with the fast changing environment and only records crucial tasks and appointments. Crucial tasks she schedules, using the due date as an indicator when she intends to work on the respective issue. Unfortunately she is often unable to accurately predict free time slots and thus frequently has to review her task list to reschedule overdue items to the next feasible time slot. Furthermore, her smart phone does not provide a weekly view that is useful to her. Therefore she uses the email she writes to her husband with an overview of the upcoming week listing all appointments per day to get an overview. This practice helps to refresh and refine her already memorized rough plan with e.g. specific time schedules. Similar to Gabriele, *Dagmar* is able to very flexibly adapt to changing circumstances as she maintains a complete overview of everything relevant to her work at one location, her Microsoft Outlook calendar. Rescheduling plans to participate in the most interesting events is a standard decision in her daily work; therefore, she records all incoming events, intentionally overbooking time slots in her calendar, to postpone the final decision on her participation up to the last moment. Yet, she is well able to stay in control of her time. This is partially due to her being sure that she has every important event visible when she needs to decide what to do. But, in addition she uses two strategies to keep in control of the many items recorded. First, noting down appointments goes hand in hand with reviewing the already entered items as she uses the monthly view of Microsoft Outlook for both. As a result a renewed overview of upcoming events is created that helps her adjusting her plans in case of sudden changes. Second, she developed a marker technique for a fast distinction between onsite and offsite locations based on tags. Based on the colour code she roughly estimates travel times to find an optimal solution how to maximize participation at successive events. *Pierre* explicitly reserves time for planning and managing his development tasks at the beginning of each release cycle (sprint) and on a daily basis. For a timely reaction to maintenance requests he habitually assesses the current situation during the day while trying to keep commitments he made for the current 'sprint'. For the latter he creates a paper based list of next actions for the following day every evening. He reviews the relevant working document (with all details of the sprint), meeting minutes as well as email messages looking for open issues.

In summary, we found four sociomaterial practices for deciding what to do next; two practices focus on planning daily work in advance, while the other two are based on situational decision making. Sara

and Pierre perform a *daily review* (1) of all their pending tasks to create a *list of tasks* they plan to work on at the respective day. Similarly Gisela's plans her work days in advance, and even *schedules* (2) time slots for *crucial tasks*. Yet, as she states due to the fast changing environment, she prefers to *keep current plans constantly in mind* (3) to be able to easily adapt to changing circumstances. Creating an overview of the upcoming week helps her refreshing and refining the already memorized rough plan. The need for frequent adjustment of plans to changing circumstances is also the reason for Gabriele's and Dagmar's practice of *maintaining an overview for situational decision making* (4) in a Word document (Gabriele) or the calendar (Dagmar).

4.3 Maintaining a well-organized workplace

As mentioned before, *Sara* prefers to have all details of her tasks close at hand in paper format. Thus, she creates a plastic folder for every task that is or will become large, which she uses to keep printouts and task details (like emails, meeting minutes, etc.) together. The plastic folders are always assembled on her desk for check-up and revising. This way she has all the task details close at hand, while still keeping her paper work structured and easily accessible. Similarly, *Gabriele* uses folders to structure her paper, but also her digital files and email. Yet, the structure used is much more elaborate, not only clustering single tasks, but representing the processes of the organization in a multi-level hierarchy. Gabriele believes that strictly adhering to this pre-defined structure is her "only chance" to find information if needed. While she actually uses the folder structure for retrieval of paper and digital documents, the search function of her email client is usually her preferred way of accessing email messages. *Gisela*, even though explicitly stating that she prefers folder structures over search as a means for organizing and retrieving documents, heavily uses both practices. For digital documents she relies on a topic-centred folder structure and archives old documents in a folder for each year, while for email she uses the search function only. In contrast, *Dagmar* uses a fine granular folder structure based on topics to organize her emails. Every time she enters an appointment in her calendar she also files the related email in an attempt to "*keep [her] inbox clean*". Finally, *Pierre* provides a particularly interesting example as he heavily relies on search for creating dynamic topic or task related collections as he needs them, as opposed to more traditional approaches like the (plastic) folders of Sara or Dagmar. To make optimal use of this feature he developed the technique to use specific keywords within email headers, meeting titles and even document chapters to "integrate" all information related to one task aspect across file formats and artefacts. In addition, he uses a fine granular folder structure on his computer to restrict these information collections to tasks of the current software release cycle.

In summary, we found five partially interrelated sociomaterial practices for maintaining a well-organized workplace; three are based on filing, while the other two rely on desktop or email search. Sara is the only interviewee who uses a *task-related filing* (1) practice, keeping printouts and task details together, yet always visible and close at hand. *Topic-related filing* (2) is more common, but occurs in different forms. While Gabriele uses a complex pre-defined structure to organize all her documents and email, Dagmar primarily uses topic folders for her emails and Gisela for documents only. In addition Gisela archives old documents in a separate *time-related folder structure* (3), as does Pierre. Using these folders helps Pierre to successfully apply his *tag-based search* (4) practice because they allow restricting search in the temporal dimension, while the pre-defined tags (or keywords) enable retrieval of specific content. Similarly, topic folders help Gabriele using a *'blind' search* (5) practice, i.e. searching without a set of consistently used tags, with her emails as only relevant information is displayed. Gisela in contrast uses open search with her emails without any folders admitting that she would prefer to have a topic-related folder structure as with her documents.

5 Discussion

The sociomaterial practice perspective helped us understanding how the two established perspectives on time management - one primarily addressing design of technological artefacts, the other strategies

people employ - can be unified and linked to knowledge workers actual work practices. Instead of focusing on the respective impacts of artefacts or strategies, we investigated practices comprising both social and material elements. The sociomaterial practice perspective thus helped us showing the importance of both human and material agency in constituting the practices we observed. On the one hand this implies that the "materiality of [an artefact] exists only in relation to the humans who use it" (Wagner et al. 2010). This becomes obvious in the very different ways our participants used artefact features like email and desktop search, reminders or calendars. While Pierre used search as a means to integrate information from a variety of file formats and tool contexts with a complex system of tags, Gisela performed 'blind' searches as a substitute for a folder structure. Similarly electronic reminders where not useful in themselves but only in combination with peoples intentions and the activities they triggered. Gabriele uses reminders to keep her main task list lean and reintegrates the information provided by reminders with her complete list of current tasks. In contrast, for Gisela electronic reminders serve as trigger for task execution, yet very often do not actually have the intended effect, but only lead to rescheduling. Finally, Sara successfully combined both approaches. By using a command-like style of recording tasks to be able to immediately execute small tasks and interpreting all other reminders as trigger for creating a task-related plastic folder. On the other hand, human practices similarly dependent on the materiality of technology. Dagmar's practice of situational adjustment of her goals and priorities is only possible because she has all information at hand when she needs to decide what to do and can use colour markers for a fast distinction between locations. Furthermore she constantly reviews the already entered items as she uses the monthly view of her calendar for noting down new appointments. As a result she is able to constantly refresh her memory for upcoming events. Similarly, the differences in Pierre's tag-based search and Sara's topical plastic folder practice of keeping a well-organized workplace are not intelligible without reference to both human and material agency involved.

But, the sociomaterial practices perspective further reminds us of the relationality of practices (Feldman and Orlikowski, 2011). Comparing the use of electronic reminders in the cases of Gabriele, Sara, and Gisela shows that the success of the respective practices heavily relies on the existence of further practices. While Gabriele uses electronic reminders as trigger for adding the respective information on her complete list of current tasks and Sara similarly reintegrates information from reminders with her task-based filing practice, Gisela has no dedicated way of integrating reminders with other practices and thus frequently is disrupted by alarms and has to reschedule tasks. Similarly, the feasibility of daily review practices of Sara and Pierre are strongly linked to their respective practices of keeping a well-organized work place. Sara only has to brows the task-related plastic folders on her desk to get an overview what needs to be done and Pierre can easily access currently relevant information with his tag-based search. For both participants the daily reviews also render the practice of keeping to-dos together with task detail applicable, because only the reviews ensure that everything gets done while there is no permanent, complete overview of all tasks. In contrast, Gabriele and Dagmar maintain such a complete list, yet the related practices are very different. They do not perform daily reviews, but prefer situational decision making using either a Word list or the electronic calendar as overview. Thus, the way how decisions on what to do next are taken is directly linked to practices of remembering tasks and vice versa. This interrelation of different practices has two implications. First, changes in one practice will likely impact other practices. And second, problems occurring in one practice, like Gisela's interruption and rescheduling issue, may be caused by the overall setup of practices and thus may well be solved in a different practice.

This is equally true for the influence previous practices have on current ones. While we found that external influences, like changes in the work environment or learning from others, triggered changes in practices, these changes were neither independent of established practices nor an immediate modification. Actually, the observed practices rather evolved over time as new practices induced by the triggers merged with previous ones. Pierre for example developed his working-document strategy when the company's organizational structure changed towards a more agile software development process. Similarly, Pierre's switch from a filing strategy to a search strategy for his email management was triggered externally when he learned how a colleague successfully used search in combination

with the consistently adding keywords to email messages. Yet, both the actual use of working-documents as well as the search strategy as we observed it during our study did not exist in this way from the beginning. They rather evolved over time as the two strategies merged, resulting for example in action items and paragraphs marked for search with keywords. Similarly, Sara developed her practice of using electronic reminders as a consequence of her work environment. While being urged to intensely use Microsoft Outlook in collaboration with her boss, she actually prefers the more tangible plastic folder practice which she adopted from a colleague. Her personal time management is a combination of both approaches, as she discovered the advantages of the reminder feature as described before, which she uses in combination with her plastic folders.

From these examples it becomes clear that both changes in the work environment, including social structure and artefacts, as well as deliberate decisions based on learning from others can trigger changes in practices. Yet, changes are hard to predict in advance due to the emergent nature of the change. Initiating, ostensive aspects of practices like the characteristics of an artefact or the ideas included in a specific method, may even become so enmeshed in the current way of working, that it requires substantial effort (an extended discussion in an interview situation in our case) to rediscover and articulate it again. *Gabriele* describes it like this: *I [...] read of it somewhere [...] I usually do not keep these theories in mind, but [just adopt some of the ideas].* Both the examples of Sara and Gabriele also indicate that people do not typically integrate all ideas of a method, or features of an artefact, in their practices, but more or less deliberately keep a few while disregarding the rest.

In addition, changes in work practices do not necessarily have to be triggered externally as the example of Dagmar's complete list practices and her extensive use of colour markers shows. While the appropriation of electronic artefacts for time management was basically triggered by changes in her work environment, the way she uses it today heavily relies on a feature she discovered coincidentally. When the practice of sending invitations to events like press conferences changed from (snail) mail and fax to email, Microsoft Outlook became crucial for time management. But only after she discovered the software's capability of colour coding events Dagmar was able to develop the practice of situated decision making based on a complete list of events as described before.

On the other hand, we also observed how practices can persist over extended periods of time regardless of changes in the work environment. An example is Gisela's practice of scheduling tasks. During the interview we were able to trace back the practice to her use of a paper calendar several years ago, where she had one page per day to add appointments, tasks and other information. Similarly, the PDA organizer she used afterwards displayed daily tasks together with appointments. Today, she still uses scheduling with due dates, even though her new smart phone does not provide the same daily overview and she has to use reminders instead to remember tasks with the associated problems described before.

6 Conclusion

Motivated by the apparent problems many knowledge workers have with managing their time effectively and the tremendous costs arising from these problems, we investigated the time management practices of five knowledge workers and analysed the processes and relationships linking these practises with related strategies and artefacts. Guided by the sociomaterial practice perspective we found 14 different practices for time management and could show the importance of both human and material agency in constituting the practices we observed. Furthermore we found practices to be highly interrelated. Similarly, previous practices also have a strong influence on current ones. Thus, changes in one practice will likely impact other practices as well and the actual effects are influenced by personal history and will be hard to predict in advance due to the emergent nature of the change.

While our study design allowed us to give detailed insights into the sociomaterial and relational nature of current time management practices, it only allowed partial investigation of the evolution of these practices. Here longitudinal studies, for example employing ethnographic or diary study methods,

would be helpful for further developing our understanding of this aspect and the processes at work here. Theoretical lenses like mangle of practice (Pickering, 1993) or affordances (Leonardi, 2011) may help in this endeavour. In these setups it is also promising to further investigate the relationship of time management practices and outcome variables identified by research in psychology, like perceived control of time or job satisfaction. In addition our study primarily focused on the practices involved in keeping track of all pending tasks (what Allen (2003) calls horizontal perspective), whereas detailed planning of larger tasks (vertical perspective, Allen (2003)) was only partially investigated, e.g. in our discussion of working documents. Further investigation of practices involved in planning and their relationship to the practices identified in this paper is required to fully capture time management of knowledge workers. So far we also did not discuss our final interpretations with the interviewees. Doing so will likely advance our understanding of the practices observed and will help validating our results.

Knowledge on psychological processes involved in habituation and learning as well as cognition may also help explaining phenomena observed in our study like the emergence and sociomaterial nature of practices. Furthermore, research on time management artefacts may leverage the interconnectedness of practices by mitigating problems appearing in one practice through supporting others or designing systems in ways that make it easier for knowledge workers to integrate them with their existing time management practices, modularization of artefacts being one example.

References

Adams, G. A., and Jex, S. M. (1999). Relationships between time management, control, work–family conflict, and strain. Journal of Occupational Health Psychology (4:1), pp. 72–77.

Allen, D. (2003). Getting things done : the art of stress-free productivity, New York: Penguin.

Bellotti, V., Ducheneaut, N., Howard, M., Smith, I., and Grinter, R. E. (2005). Quality versus quantity: e-mail-centric task management and its relation with overload. Human Computer Interaction (20:1), pp. 89–138.

Bergman, O., Beyth-Marom, R., and Nachmias, R. (2006). The project fragmentation problem in personal information management. In Proceedings of the SIGCHI conference on Human factors in computing systems Montréal, Québec, Canada: ACM, pp. 271–274.

Bondarenko, O., and Janssen, R. (2005). Documents at Hand: Learning from Paper to Improve Digital Technologies. In Proceedings of the SIGCHI conference on Human factors in computing systems New York, NY, USA: ACM, pp. 121–130.

Camacho, J., Favela, J., and Gonzalez, V. (2006). Supporting the Management of Multiple Activities in Mobile Collaborative Working Environments. In Groupware: Design, Implementation, and Use, pp. 381–388.

Charmaz, K. (2006). Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis, Sage Publications (CA).

Claessens, B. J. C., Eerde, W. V., Rutte, C. G., and Roe, R. A. (2004). Planning behavior and perceived control of time at work. Journal of Organizational Behavior (25:8), pp. 937–950.

Cox, T. 2000. Research on work-related stress, Luxembourg : Lanham, Md: Office for Official Publications of the European Communities ; Bernan Associates [distributor].

Czerwinski, M., Horvitz, E., and Wilhite, S. (2004). A diary study of task switching and interruptions. In Proceedings of the SIGCHI conference on Human factors in computing systems Vienna, Austria: ACM, pp. 175–182.

Davis, E. (1999). "Does your life work? The Management Today Work-Life Survey," Management Today, August 1 1999.

Van Eerde, W. (2003). Procrastination at Work and Time Management Training. The Journal of Psychology (137:5), pp. 421–34.

Feldman, M. S., and Orlikowski, W. J. (2011). Theorizing Practice and Practicing Theory. Organization Science (22:5), pp. 1240–1253.

Feldman, M. S., and Pentland, B. T.(2003). Reconceptualizing organizational routines as a source of flexibility and change. Administrative Science Quarterly (48:1), pp. 94.

Garhammer, M. (2002). Pace of Life and Enjoyment of Life. Journal of Happiness Studies (3:3), pp. 217–256.

González, V. M., and Mark, G. (2005). Managing currents of work: multi-tasking among multiple collaborations. In Proceedings of the ninth conference on European Conference on Computer Supported Cooperative Work Paris, France: Springer-Verlag New York, Inc., pp. 143–162.

Green, P., and Skinner, D. (2005). Does time management training work? An evaluation. International Journal of Training & Development (9:2), pp. 124–139.

Häfner, A., and Stock, A. (2010). Time management training and perceived control of time at work. The Journal of Psychology (144:5), pp. 429–447.

Janssen, R., and Poot, H. de. (2006). Information overload: why some people seem to suffer more than others. In Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles Oslo, Norway: ACM, pp. 397–400.

Jex, S. M., and Elacqua, T. C. (1999). Time Management as a Moderator of Relations between Stressors and Employee Strain. Work & Stress (13:2), pp. 182–191.

Kanter, R. M. (2008). Transforming Giants. Harvard Business Review (86:1), pp. 43–52.

Kidd, A. (1994). The marks are on the knowledge worker. In Proceedings of the SIGCHI conference on Human factors in computing systems New York, NY, USA: ACM, pp. 186–191.

Klein, H. K., and Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. MIS Quarterly (23:1), pp. 67–93.

Lakein, A. (1989). How to Get Control of Your Time and Your Life. (Reissue,) Signet.

Lee, A. S. (1991). Integrating Positivist and Interpretive Approaches to Organizational Research. Organization Science (2:4), pp. 342–365.

Leonardi, P. M. (2011). When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies. MIS Quarterly (35:1).

Macan, T. H. (1994). Time management: Test of a process model. Journal of Applied Psychology (79:3), pp. 381.

Orlikowski, W. J., and Scott, S. V. (2008). 10   Sociomateriality: Challenging the Separation of Technology, Work and Organization. The Academy of Management Annals (2:1), pp. 433–474.

Orlikowski, W. J., and Yates, J. (2002). It's About Time: Temporal Structuring in Organizations. Organization Science (13:6), pp. 684–700.

Patton, M. Q. (1990). Qualitative Evaluation and Research Methods, (2nd ed,) Sage Publications, Inc.

Pickering, A. (1993). The Mangle of Practice: Agency and Emergence in the Sociology of Science. American Journal of Sociology (99:3), pp. 559–589.

Rattenbury, T., and Canny, J. (2007). CAAD: an automatic task support system. In Proceedings of the SIGCHI conference on Human factors in computing systems San Jose, California, USA: ACM, pp. 687–696.

Sarker, S., and Lee, A. S. (2006). Does the Use of Computer-Based BPC Tools Contribute to Redesign Effectiveness? Insights from a Hermeneutic Study. IEEE Transactions on Engineering Management (53:1), pp. 130–145.

Sarker, Suprateek, Sarker, Saonee, Sahaym, A., and Bjørn-Andersen, N. (2012). Exploring Value Cocreation in Relationships Between an Erp Vendor and Its Partners: A Revelatory Case Study. MIS Quarterly (36:1).

Sarker, Suprateek, Sarker, Saonee, and Sidorova, A. (2006). Understanding Business Process Change Failure: An Actor-Network Perspective. Journal of Management Information Systems (23:1), pp. 51–86.

Wagner, E. L., Newell, S., and Piccoli, G. (2010). Understanding Project Survival in an ES Environment: A Sociomaterial Practice Perspective*. Journal of the Association for Information Systems (11:5), pp. 276–297.

Young, I. 2008. Mental Models: Aligning Design Strategy with Human Behavior, (1. ed,)Rosenfeld Media.