MONITORING PERSONAL COMPUTING PRACTICES IN REAL WORLD KNOWLEDGE WORK SETTINGS

Needs, challenges and options

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Abstract: In this position paper the needs and options for the realistic, real time and privacy preserving means for unobtrusively observing, monitoring and understanding knowledge work practices in real work settings in order to understand better the relations between computing practices, knowledge work methods and mental work wellbeing and performance outputs of personal knowledge work is discussed. A preliminary approach taken in a research project (work-in-progress) which aims to study these relationships is presented.

1 INTRODUCTION

According recent European wide opinion survey study on work conditions, reorganization of work, high amount of work and unclear responsibilities are among the main subjectively experienced sources of work-related stress (European Agency for Safety and Health at Work, 2013). At the same time especially workers in managerial and expert positions are facing difficulties to prioritize their tasks and manage their work time spending (Bevins, F. & De Smet, A. (2013).

Contemporary knowledge work is creating new kinds challenges for the workers well-being. For example in Finland, the amount memory disorders diagnosed among young working adults have risen lately. One hypothesis for the rise is that the hectic rhythm of work, the abundance of information processing needs and the number information technological appliances used in the work are creating pressures for the human performance. Information technology have enabled especially knowledge work processes (or at least communication related to the work processes) to be accelerated. But why does this technology and acceleration cause negative symptoms and disturbances of well-being? What could be done to diminish the harmful effects?

Ergonomics is applied multidisciplinary science devoted to the enhancement of fit between human characteristics and tools and environments of the work. It is defined as "(...) scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." (The International Ergonomics Association, 2010). Further, the design target of ergonomics can be either the tools used in the work or the working methods applied in the work. Depending on the target of the design, methods of ergonomic design vary. In the ergonomic design of human working methods, for example, modeling the elements of work tasks and sequences of the tasks are analyzed. Classical approaches to analyze ergonomics of the methods of physical work are time-motion studies and posture studies. In the case of physical work, the analysis of the details of the work methods try to detect work techniques which create strain, excessive load and risks.

In this position paper we discuss the needs and options for the realistic, real time and privacy preserving means for unobtrusively monitoring knowledge work practices in real work settings. The aim is to observe and understand better the relations between computing practices, knowledge work methods and mental work wellbeing and performance outputs of personal knowledge work. We present preliminary approach taken in a research project (work-in-progress) which aims to study these relationships in personal knowledge work.

2 NEED FOR AN APPROACH FOR OBSERVING KNOWLEDGE WORK MICROPRACTICES

So far, quite little is known about the practical working methods of knowledge workers, especially when the work is highly collaborative. There is scarcity of studies elaborating, for example, details of the work load planning at macro and micro levels, principles applied in work sequencing and ordering, management of work queues, practical organization and coordination methods and principles between actors providing resources to the collaborative effort. In terms of physical manufacturing operations terminology, a single knowledge worker can be compared to the "autonomous cell", which perhaps have got specialized skills and abilities (resources) to contribute to the realization of a shared object of work The worker has got the freedom to manage the flow of different kinds of resource and product/semiproduct inputs and outputs flowing to and from his/her cell. To coordinate the overall collaborative "production" of the object - be it a patient requiring care, an article to be written, plan to be designed, a campaign to be launched, or an educational service to be provided - the autonomous cells need to consciously and in a coordinated manner exchange and combine resources, typically within a constrained time.

In the design of ergonomics of physical work, the focus of scrutiny is on the analysis of the methods of work to avoid overload, strain and injuries. Should not the focus of ergonomic design of knowledge work be also in the methods and techniques of knowledge work, especially the analysis of actual conventions of combination, ordering and coordination of work effort of multiple workers in collaborative endeavor? When trying to uncover the details of everyday combination, ordering and coordination habits/conventions/principles in knowledge work, there is a need for new conceptual tools, as well as observation tools.

While most of the delivery and coordination of resources in knowledge work is executed by messages sent via different electronic channels, the focal coordination center of an individual knowledge worker seems to be, for example, the email inbox. Email applications are used for many other functional purposes than just interpersonal messaging. It is like an unordered work queue, requiring constant attention, updating, monitoring and cleaning. Every message represents either some kind of work order or delivery of a certain resource. Certainly most of the knowledge workers also create and seek resources independently, but again, there might exist a need to deliver and combine those resources to benefit some bigger goal/object.

Our hypothesis is that the factors plaguing the performance of knowledge work (for example, suffering from interruptions, feeling of loss of control, fragmentation and feeling of declined subjective work productivity) originate from the unpreparedness of the workforce to adapt to the new realities of coordination requirements and environment of contemporary collaborative knowledge work, manifesting in the constant flow of work reorganizing messages from different electronic channels. If we want to relieve the symptoms, we need to study carefully the current computing and coordination methods and habits individuals and work communities employ. We should analytically detect potential inefficiencies especially in the processing of these messages and implications of the message management for the structuring of work both at individual and group level. Further, detailed analysis of electronic messaging management may reveal the otherwise rather hidden characteristics of personal work design in an objective way. The analysis may shed light into the nature, amount and density of interdependencies between actors and resources in personal knowledge work, and the patterns and habits of managing them. Messaging management strategies can vividly reflect either conscious or accidental priority of goals, commitments and tasks, and work load management and task awareness maintenance tactics. The immersiveness of messaging activity (e.g. constant curiosity rewards available from frequent checking of email) shapes the workflow

3 RESEARCH DESIGN FOR STUDYING RELATIONS BETWEEN COMPUTING PRACTICES, WORK WELLBEING AND PERFORMANCE

Our work-in-progress research project tackles the above issues and hypotheses with a following conceptual, exploratory framework (Figure 1.)

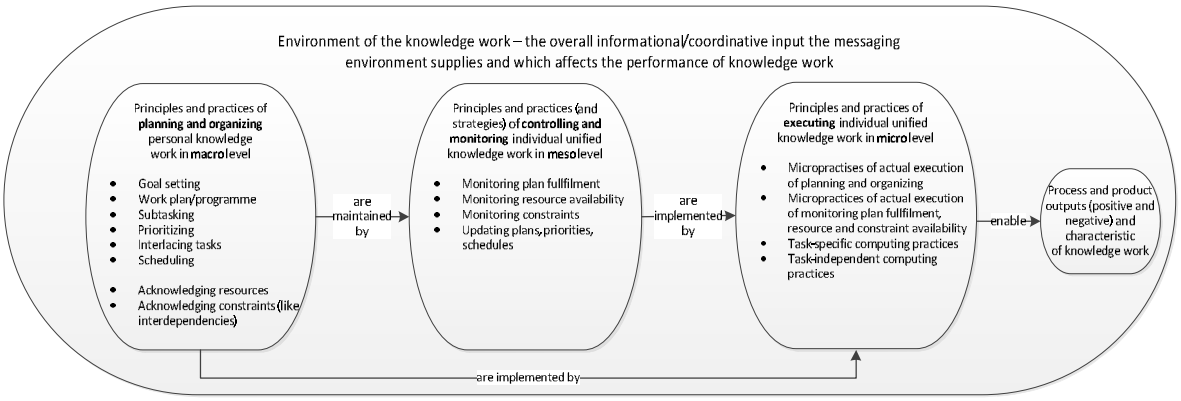

Figure 1. Conceptual framework for observing and analysing drivers of personal knowledge work processes and outcomes.

To understand interaction between the patterns of knowledge work and the variable performance process and product outputs like subjectively experienced mental work wellbeing and subjective productivity of the work, following specific research questions are pursued in the project studying voluntary knowledge workers in their real work environment:

1) What are the characteristics of planned and actual knowledge work methods (sequencing, prioritizing, time resourcing) and information and messaging environment of the study participants, and how computing practices reflect them?
2) What is the nature and amount of interruptions, task switching and multitasking present in the work flow?
3) What kind of subjective work wellbeing and performance experiences (sense of control, sense of achievement, stress and subjective productivity) the participants have?
4) How the work methods, characteristics of the information environment, and subjective experiences are related?
5) How the monitoring and self-monitoring of knowledge work methods could be implemented in real world work settings?

Task planning and task fulfillment was explored with the help on short web questionnaire form which was filled every morning during the study period. The study period was five office working days. The participants were reminded about the form filling every morning and every afternoon. In the form participant was asked to briefly name the tasks she was going execute during the day, and to assess also the priority and urgency of the tasks – should the task be ready preferably at the end of that working day or not. At the end of the office day participants were asked to fill a web form where they reported what tasks they actually did during the ways, have they been able to fulfill their plan and if not, what was the reason for that.

Amount of email activities was studied by asking at the end of every day how many emails they had processed - received, sent, filed or destroyed. Respondents made the calculations be themselves.

Web survey based experience sampling method was applied as a method to collect participants' subjective work wellbeing and performance assessments during the monitoring days. Every afternoon participants filled web form where they were asked to react to a set statements considering their experience of sense of control, hurry, fragmentedness etc. during the day. Statements were evaluated with a Likert-scale.

Time management software *ManicTime* was utilized as a tool to trace moment-to-moment desktop activity of individual worker in office work environment. The software keeps log of application and file use, recording moments of window activations, listing application and file names utilized and time spent in each. In addition, off-the-shelf screen navigation video recording software *Snagit* was used to capture the actual screen activity in natural richness. Participants had opportunity to stop both time management and screen navigation video recording whenever they wanted.

Study participants were able to indicate the part of the recordings that they wanted to keep private or delete it, and both tracing data were analysed quantitatively and qualitatively. From tracing data the amounts, frequencies and durations of task events were calculated. Tracing data was compared qualitatively with the subjective wellbeing and performance experience survey results. The analysis

of tracing data was supported with the think aloud interviews with the study participants, where they associated their task plans and goals to the task events in the tracing data set.

The feedback of the study was provided with written report and graphical illustrations of different measures observed during the monitoring period.

4 PRELIMINARY RESULTS

direct distributions

4 PRIVACY CHALLENGES WHEN MONITORING REAL-WORLD COMPUTING OF A KNOWLEDGE WORKER

The issue of privacy must be taken into account from three perspectives, legislative, organizational and personal perspective. The perspectives are categories that consist of information that must be or will be keep hidden from outside viewers. The privacy here refers also to habits that informants are not willing to reveal or from organizational perspective, non-relevant knowledge of statuses or dynamics of organization. As the research on information ergonomics falls into tradition of naturalistic worklife studies, not interpretation of social factors of organization the last point is also important.

The legislative perspective of privacy is somewhat compelling, i.e. there are pieces of information that must be kept from outside viewers and are delicate by their nature. This set consists of personal information of employees that are under some privacy or secrecy rule, e.g. banking information or health information. If this kind of information is handled it is important that no traces of personality is left to public data. Moreover, some pieces of information are categorically set private and must be excluded from research material.

Organisational perspective of privacy is the issue of competitive advantage, i.e. the information that may harm operations of the organization if subject to publicity. Most strategic and operational information is such. However, in most cases covering NDA would tackle this issue. However, if there are internal issues within the organization then the process of acquiring data might be subject to bias due to urge to keep some information from the outsiders.

The personal perspective is the most difficult one, since there are pieces of information that are so personal and private that it might alter the way the informant behaves. Personal correspondence, use of social media, use of non-work related sites etc. might put the whole research setting to jeopardy. Informants may alter their habits or even try to affect the monitoring if they face a motive conflict with personal habits and desired way to act.

5 USE OF SELF-MONITORING AS “SELF-HELP”

Even this paper approaches using off-the-self monitoring software and equipment as a part of a research agenda those can be utilized also part of self-improvement. If monitoring has some kind of normative objective those tools and lessons can be employed also by the workers themselves. Self-monitoring can reveal knowledge on habit that is implicit, yet very relevant in sense of worklife performance. While testing the equipment for the study presented here, researchers find some drastic habits of themselves. Revealing bad or non-productive habits is part of enhancing ones performance. It can also be stated that by introducing monitoring as a part of research agenda a new tool is deployed. Using that tool is an issue of self-determination, yet a person willing to make a difference might find them useful. Moreover, introducing tools is actually part of intervention as the researchers find some shortcomings in outside monitoring and using it to derive interventions or guidelines. It is also the issue on extrinsic and intrinsic motivation. Self-knowledge on ones habits may lead to positive outcomes by better motivation to make change.

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