Ordering actors, organising work

Thomas Østerlie and Glenn Munkvold
Norwegian University of Science and Technology
thomas.osterlie@idi.ntnu.no, glenn.munkvold@idi.ntnu.no

Abstract. This paper looks at the organising of work, as in who does what, when and how. We explore the relationship between work as situated action on the one hand and unfolding within the confines of stable social structures on the other. Being an underdeveloped topic of research, we analyse how more stable structures of work are being produced. By conceptualising the organising of work as a special case of ordering actors in a network, we find that the organising of work is enacted and distributed among actors. We also argue that the organising of work can't be treated as theoretically pre-given, but rather as emergent.

Introduction

Those of us studying everyday work are caught in the dilemma of reconciling action, the temporal element of everyday work, with wider and more stable social structures. On the one hand we recognise the temporal element of action in everyday work. On the other we also recognise that work unfolds within the frames of more stable social relationships like terms of employment or organisational affiliation in which the individual's responsibilities are connected to specific roles within the larger organisation. As Orr (1996:10) puts it: "We are left, then, with a possible conflict between work as doing ... and work as activities explicitly described or prescribed".

Approaches to the study of work is often categorised in terms of a simple dichotomy between work as represented on the one hand and work as practiced on the other (see Hutchins 1991, Brown & Duguid 1991, Berg & Timmermans 2000

for example uses of this dichotomy). The first approach places work within a formal, pre-planned context. Work is here organised in accordance with pre-designed plans that provide descriptions of the work process for optimal efficiency reflected by the work setting. The second approach locates work within a social and situated context where work adapts to the particulars of the situation. In this latter category work unfolds more or less independent of formalities and pre-designed plans (Orr 1996; Suchman 1987), or at least that non-routine work and incidents require people to act independent of pre-determined roles and plans (Hutchins 1991).

Both Fox (2000) and Barnes (2001) observe that there is a gap between the two approaches with a tendency of focusing on either situated action or the pre-planning and designing of work processes while ignoring the other dimension of work. It is our observation that the dynamics of the interaction between the pre-planned and the situated therefore remains underdeveloped. Our interest in these dynamics follows our object of study. We study software in use, where our object of study is software use in the context of everyday work. Within the field of computer supported collaborative work, one of the authors studies the introduction of software in a hospital ward and its integration with nursing work. The other author studies the use of software tools in large-scale open source software development within the field of software engineering. Wherein existing research literature in our fields, and especially within the field of software engineering, tends to focus on the supporting capabilities of software in use, our research goal is to critically examine the effects of software use on work; be it nursing or software development.

The paper is structured as follows. First we present different approaches to studying work. The goal of the section is to build a vocabulary of organising work and to contextualise our approach to the study of work. Next we present our two cases, and the empirical methods employed for data collection. We then use the empirical material to analyse the organising of work. The paper is concluded with a section where we discuss the implications of our analysis on the study of work.

Approaches to studying work

In this section we discuss different approaches to studying work. The purpose of this section is to both build a vocabulary to use in describing our empirical findings and to analyse these findings. Following the dichotomy for the study of work from the introduction, we first present an idealist approach to the study of work. Using a critique of the idealist approach as a starting point, we present a practice-based approach to the study of work. The section is concluded with a discussion possible approaches to unwrap the dynamics between work as represented and work as action.

Idealist approaches

Schein (1972) studies work in the context of the formal organisation. With a overall goal, the organisation coordinates its members' activities. Through a coordinated effort the organisation's members assist each other in working toward a common goal. Coordination of work is achieved with two mechanisms: division of work through differentiation of functions, and the integration of these functions. To rationally achieve the organisations' common goal, different people perform different activities in a coordinated manner. Work is divided according to rational principles of differentiation of functions. Functions are found through splitting the organisation's common goal into sub-goals. Functions are assigned separate sections or individuals within the organisation. For an overall coordination of the organisation, an integrating function is required to ensure that the different sections and individuals work toward the common goal. Such an overall coordination of the organisation usually befalls a hierarchy of authority. The hierarchy controls the organisation's sections and individual through guidance, limitation, control, and information. Complementing this authority is also the voluntary self-discipline of the organisation's members in working towards the common goal.

The organisation of work is defined in terms of roles (typically connected with terms of employment) connected with areas of responsibility. Each role has authority to ensure that whatever takes place within their area of responsibility does so according to the plans of higher authorities. Coordination is therefore the result of the highest authorities providing a plan of who does what within the organisation. Plans coordinate the activities of the organisation's members to achieve a clearly defined goal through the division of work and functions enforced by a hierarchy of authority. The plan describes roles and activities required to reach the goal. "Coordination is thus implemented by laying out a kind of blueprint of who is responsible for what" (Schein 1972:15)

Levitt & March (1988) provides one way to lay out such a blueprint through routines. Routines encode roles and responsibilities for specific activities within the organisation. Wherein Schein (1972) argues that blueprints should be laid down on the basis of rational criteria of job division and coordination, Levitt & March (1988:322) argue that "routines are transformed at the same time as the organization learns which of them to pursue".

Common to both approaches is the evaluation of plans according to overall goals, or, as Levitt & March (ibid.:320) puts it, "organisations are oriented to targets". Another commonality is that idealised descriptions of work is represented by and encoded in plans where it is described in terms of routines, roles, and responsibilities. Work is regarded as the translation of descriptions of work processes to action for concrete situations. The underlying metaphor for this approach is the automated production line where work is regarded as systemic and in terms of sequential processes.

Practice-based approaches

Polyani (1966) points out the tacit dimension of action, that people sometimes act without being able to give rational explanations for our conducts. The tacit dimension has become an important aspect for the way we understand work (Brown & Duguid 1991). The idealists' representations of work fail to account for this dimension of work. In this lies the implied argument that work is not a rational, planned delegation of work, but a question of action, skills, and competencies. Work in action is called practice. Practice implies doing and is the situatedness of human action (Suchman 1987).

In practice-based approaches to the study of work, emphasis is on the active and productive processes of work (Carlsen et al. 2004; Cook & Brown 1999). Practices are driven, but not limited, to the tacit dimension; it is improvised, spontaneous and hallmarked by responses to changing and unpredictable environments (Brown & Duguid 2001). One such practice-based approach to work is communities of practice (COP) (Brown & Duguid 1991; Lave & Wenger 1991; Wenger 1998).

Wenger (1998) argues that work is organised along three dimensions in a COP. First, work is a joint enterprise that is continually renegotiated by the members of the community. Second, work is a mutual engagement that binds the members together into a social entity. Third, work is a shared repertoire of common resources that the members have developed over time (routines, vocabulary, artefacts, etc). Brown & Duguid (1991) see the organising of work within a COP along three different dimensions: narration, collaboration, and social construction. Common to them both is that work is considered a relation between the subject and the world, assuming that the subject adapts to the surroundings by means of participating in a COP.

Unpacking the dynamics between representation and action

Common to both idealist and practice-based approaches to the study of work is the central questions of who does what, when and how. Schein (1972) sees work unfolding within the organisation, a stable social structure made up of roles, responsibilities, hierarchies of authority, and routines. Answers to these central questions are addressed by arguing for delegation and integration as the mechanisms for coordinating work. COP sees work unfolding within the community. The answer to the central questions is to be found in the community. Common to both approaches is what we call the *organising of work.*

Wherein the idealist approach focuses on the description and representation of work, the practice-based approach focuses on the individual skills and competencies of the worker. Barnes (2001:21) observes that "idealist writers have sometimes overlooked the role of practice altogether". On the other hand, Fox (2000:858) points out that "[o]ne of the theoretical difficulties with early COPT was how to look at practices, which essentially include a temporal element, like

action and activity, within a context of wider and relatively stable social structures." The same kind of critique is valid towards most practice-based approaches, or as Barnes (2001:21) argues that "to react against [the idealist position] by giving attention exclusively to the role of practice … amounts to an ungrounded prejudice in favour of know-how at the expense of know-that, in favour of skill and competence at the expense of information and representation".

The central problem related to the organising of work is to conceptualise the dynamics between information and representation in the situated practice of work.

Our experiences and the way we perceive the world can never be replicated perfectly, but to be able to make visible different world-views we need common denominators. That is entities that are interpreted differently in different social worlds, but still remain common enough to be recognisable (Star & Griesemer, 1989:393). These entities are what Star & Griesemer (1989) call boundary objects. In a practice perspective these boundary objects are means of representing and transforming work. They enable collaborative work across social worlds.

Another way of understanding how encoded descriptions of work influence action is through Latour & Woolgar's (1986) inscription device. The inscription device is recognised by two characteristics. First of all, the inscription device holds up in Euclidean space. It remains physically the same regardless of its geographical location. Secondly, the inscription device arranges a patterned set of relations. These relations inscribe a potential reality. Inserted into the right set of relations somewhere else, the inscription device points to and help produce the same reality. As such, the inscription device enacts the reality with which it is inscribed stabilising this reality across time and space.

Wherein Latour & Woolgar (1986) follows the production of these inscription devices, our focus in this paper is to trace out the effect such devices, when circulated, have on situated work. While we study the dynamics of the interaction between the pre-planned and the situated also includes organisational descriptions, the description of roles, and institutions, we limit our focus in this paper. We the study how technologies, understood in terms of inscription devices, organise work. We do not limit our focus to information and communications technologies exclusively, but adopt an approach where technology encompasses both electronic and analogue artefacts.

Two case studies

In this section we present our empirical material. First we provide an overview of our empirical study. We then present our research methods, before we conclude with two subsections where we present specific episodes along with descriptions of them.

Overview

We have chosen a two-case study design. These two cases are complimentary because everyday work unfolds within quite different contexts. In the first case, work takes place within a loosely organised group of volunteer developers and users. Even though a volunteer effort, roles and responsibilities are clearly defined and formalised along with a hierarchy of authority within the group. In our second case, work takes place within a context with rigid hierarchies, and with clearly defined roles and responsibilities.

Method

This paper is based on the field work for two interpretive (Klein & Myers 1999) case studies. In the first case we study work in a volunteer effort to develop an operating system. In the second we study work in a clinical work setting. While different in terms of organisational formalism and physical proximity, the methodological approaches followed are quite analogous. In both cases emphasis is on work as it unfolds in everyday practice. We both "take concrete, meaningful societal practices as a *direct object* of study" (Chaiklin 1996:384). We are in particularly interested in the role of material artefacts in everyday work.

Methodologically both cases are based on ethnographic fieldwork and to a large extend reliant on participant observations as a primary method (Fetterman 1998). Both cases come close to what has been labelled ethnographic studies of technology (Tjora 2002) thus placing our approaches into the broader landscape of similar studies (e.g. Suchman 1987; Hutchins 1995; Berg 1999; Zuboff 1988). Some of the main characteristics of two cases are highlighted in Table 1.

	Open source case	**Medical care case**
Methodological approach	Ethnographic	Ethnographic
Period	Two periods. First period two months of observation, and a month of participation. Second period three months of participation.	Two periods of one month each
Type of involvement	Initially participating as an observer, but later on observing as a participant	First period observing as a participant, second period participating as an observer
Visibility of researcher	Only when posting messages on IRC	Physically present, always visible
Data gathering and type of data	Observing and logging activities in IRC-channels and two mailing lists. Taking substantive field notes while observing Collecting data from web-pages Informal e-mail interviews	Observation in a hospital ward, taking substantive field notes. Collecting documents (documents analysis). Recording meetings. Taking photos Informal interviews
Type of analysis	Quantitative descriptive analysis of the IRC logs and mailing list. Qualitative analysis mainly based on the field notes.	Qualitative analysis
Objective guiding our analysis	Open coding, emphasising how work is organised	Guided exploration. Emphasis on how work is organised
End-product of analysis	Case vignettes	Case vignettes

Table 1 Comparison of cases

As an observer, the researcher tries to get as close as possible to the case being studied, without going native (Hong & Duff 2002). A key to success in participant observation thus becomes how to gain legitimacy, and how to become a trusted member of the community. Simultaneously one should beware not to get too involved and unable to distance oneself from the field. The balancing between the two is not easy, and during the fieldwork, the researcher continuously needs to adjust his/her actions according to the climate among the participant. In both our cases different approaches were followed to make sure we had access to the field.

While in the medical care case, the researcher got involved by working observing as a participant, in the open source case the researcher started out more passively as a participant observation (see Hong and Duff (2002) about the distinction). Both projects changed a lot during the case studies. For instance in the open source project the researcher had to actively get involved in the project activities to get access to some more data. Below we provide a more concrete description of the two cases

The open source case

In our first case we study an open source community, Gentoo, developing an operating system. The operating system consists of an operating system kernel integrated with third-party software packages ranging from runtime libraries to end-user applications. Neither the kernel nor the third-party software is developed by Gentoo. The Gentoo developers' main job is integrating the third-party software into a fully functional operating system. As of November 2004, over 6000 third-party software packages

While Gentoo is based on volunteer work, there is a formal distribution of roles and responsibilities along with a hierarchy of authority or management structure as it is called in Gentoo (Robbins 2003). Many volunteers participate in developing the operating system, but being an official developer is a restricted title held by some 200 participants (as of November 2004). Becoming an official developer is a transitory process of finding a sponsor among the official developer, or being found by a sponsor, passing a quiz, and then be adopted as official developer with access permissions. Once adopted, developers are given responsibilities by connecting them to herds.

Herds are areas of responsibilities defined by a collection of third party software associated with a number of developers. The responsibility of the developers is to make sure that the third-party software in their herd integrates properly with the operating system. A developer may be connected with one or more herds.

The operating system and updates to it are distributed over the Internet. New and updated third-party software packages are made available for download from a central database. Installing and updating software is the task manually handled by users of the operating system.

The medical care case

Our second case takes place in a rheumatology ward in a Norwegian hospital. The typical patient being admitted to this ward is suffering from a chronic disease. Handling such illnesses requires extensive, cooperative and inter-disciplinary dialogue among health professionals populating the ward.

The ward is divided into a bed ward, a polyclinic and a centre for mothers with rheumatic diseases. The bed ward has 16 beds and is organised as a primary care

unit where a primary caretaker nurses admitted patients. Furthermore the ward is populated by various professionals like physicians, an ergonomist, a physiotherapist, specialists on rheumatic diseases, a social worker, and so on. An important part of the primary caretakers work is coordinating the treatment provided by the ward. The polyclinic handle patients that do not need to admitted. Distinct from the all-purpose characteristic of the bed ward, the polyclinic is mainly doing consultations and has approximately 4000 consultations per year. The centre for mothers with rheumatic diseases gives advice and guidance to women and their relatives on how to handle a rheumatic disease in relation to pregnancy and as a parent. An integrated part of the everyday treatment of patients is doing research and development, education and teaching.

Electronic Patient Records (EPR) have been introduced at the ward. However the working practices still go around paper and oral communication as the most common way to organise work.

Ordering people, organising work

In this subsection specific episodes are from our field work are presented to illustrate how ways of organising are enacted in everyday work. Our argument is that roles are not acted out in a vacuum, but relies on shifting people into positions where they act accordingly.

> Episode #1. Monday morning. A patient is admitted to the ward. He is seriously ill, but does not himself know what is the matter with him. One day later, he is being examined by one of the physicians at the ward. Unable to make a diagnosis, the physician decides to take blood samples and in addition send the patient to a whole-body CT screening. On Wednesday afternoon the results from the lab-results are made available in the Electronic Patient Record (EPR). The patient is suffering from a malignant, spinal tumour. A couple of hours later, that very same day, one of the nurses is being asked by the patient if she knows the results of the tests. She does not know, she says, although she has seen test results in the EPR. In fact she has been trying to locate the physician that examined the patient, as he is the one responsible for informing the patient about the results of the CT-screening. However, the physician has gone for the day. Upset about not finding the physician, the nurse has turned to her companions for advice. After a lot of back and forth discussing the problem with the other nurses on watch, they come to the conclusion not to inform the patient themselves. The rest of the evening passes while the patient remains in limbo as to his serious illness

While "to speak is to do something" (Foucault 1972), not speaking at all says amounts. It says amounts about the division of work between nurses, physicians, and patients. The resident physicians diagnose patients. The nurses tend to the

patients according to the physicians' diagnoses. Discussions about diagnoses are to be made between the physician, potential test results, the patient and his body. However, in this case it is not a question of competence or skill. Knowing the test results, the nurses are able to set the diagnosis, too. It is only a matter of telling the patient. No need to wait for the resident physicians to return on Thursday. Yet, they say nothing, leaving that to the physician.

Compare the short episode above with the following episode from the software development case:

> Episode #2: Monday. For some it is morning, for others afternoon, and yet others it is night. The place is an IRC channel. Logged on are the Gentoo managers and a number of developers. An official bi-weekly meeting is in progress. Topic of the day is the launch of a new sub-project, which details are of no relevance. Two developers responsible for the new sub-project, Mark and Neal, are presenting the sub-project's declaration of intentions and plan of actions. One of these goals is the introduction of an abstract programmable interface, an API, on top of a database. Someone asks: "will [version] 2.0.50 [of the software] be the first one with a defined stable api?" Looking for Angus, the project manager of the top-level project, but failing to find him, Mark responds: "I can't really say that, Angus makes the choices what goes in and what changes." The guy asking the question responds: "all i want to know is IF things will change, additions are fine as long as the existing api doesn't change". A minute of silence passes before the guy asking the question concedes: "guess i'll have to bug Angus with that."

It falls under the project managers' area of responsibility to determine what goes into a version of the software and not. However, this is not enacted by the project manager himself, but rather by Mark. By defining the decision not to fall under his area of responsibility and by not answering, Mark is performing an organisation where the guy asking the question and Angus are shifted into positions. As Angus is not present he is shifted into the position of making the decision. The guy asking the question is shifted into the position of asking Angus for an answer.

It is our observation that instead of speaking of roles, it is more suitable to speak about ways of organising. The nurse in episode #1 is not merely acting out her own role by not telling the patient about the tumour, she is also actively acting out the physicians' role and that of the patient. The same with Mark, he is acting out the roles of both Angus and the guy asking a question. Instead of speaking about the person acting according to his or her role, we can instead talk about how ways of organising are enacted. This moves focus away from the individual to the social interplay. Making the enacted way of organising work, those being shifted into position must act according to the roles they are given. This point, however, becomes clearer at moments of breakdown. Let's return to the medical care case once more:

> Episode #3. Monday morning. We are talking, me, the researcher, and a nurse working at the ward. I tell her about the tumour episode (see episode #1 above), turning to the point about roles and responsibilities and the role of nurses. She doesn't know this episode, she tells me, but these things often occur. She tells me about a similar episode. It is an episode she has experienced herself. Can I tape this? I ask before she continues. She doesn't mind. There's a brief pause while I turn on my tape recorder. She relates an episode from her days in nursing school. It is her final period as a student trainee at the hospital. It is at the children's ward. A sick boy's father and brother are visiting a seriously ill boy admitted to the ward. When the relatives ask the nursing student if the boy is mortally sick, she answers yes, he is. "It was something everyone [working on the ward] knew," she says to me, remembering the situation. "So I told them." Her telling the relatives caused a stirrup at the ward. She was told that it was the physician's task to talk with relatives about these things, but she knew the family the better. She was the boy's primary caretaker at the ward, and it was therefore natural for her to inform the relatives. If any questions had arisen that she couldn't answer, she would have referred the relatives to a physician. Even though, she says, everyone was of the opinion that I was out of bounds. It was not something a nursing student should have done, although relating the story today she thinks many nurses would have acted likewise in a similar situation.

By telling the relatives about the serious condition of the sick boy, the nursing student shifts the physicians and nurses working in the ward into positions they refuse to assume. The physicians and nurses of the ward refuse to enact a way of organising where physicians not placed in front as the primary messenger of bad news. Instead the physicians and nurses at the ward enact a way of organising work where it is not nursing students' role to tell relatives about the seriousness of patients' illness. By refusing to be shifted into position, they enact a different way of organising than the nursing student. The nursing student does not act out her role in a vacuum. Instead she relies on 1) shifting others into position, and 2) that the others' act according to their new positions.

The role of technology

Above we illustrate social mechanisms for organising. In this section the same topic is addressed by attending to the way technology also enact ways of organising by shifting people into positions, and thus regulating and coordinating the actions that are taken.

> Episode #5: "Hmm," starts Matz' statement on the IRC channel. "There is a problem with release X. John's fix and mine are in conflict." The release is made public. There is no way of revoking the broken software. It simply has to be fixed. It doesn't take long before Matz and John have a fix. Their only problem is that the two of them don't have access to upload their fix to the distribution system where they can make their fix available for download. Only the project

leader has those access rights. He is now asleep, in a different time zone, and can't be woken. While it takes less than an hour to fix the problem, it will take more than a day before the fix can be distributed through the distribution system.

The distribution system's access control prevents the two developers, Matz and John, from making their fix available. While they have the skills and competence to fix the problem with release X, they are shifted into positions by the distribution system's access control. The access control enacts an organising where project managers have control over everything that is to be made available through the distribution system. As long as the access control stop them from uploading their fix to the distribution, Matz and John can do little more than wait for the project manager to wake up and come on-line.

Episode #6. Thursday afternoon. A bedridden patient is expecting a visitor. Her son has promised to pay a visit. Around four o'clock in the afternoon he arrives. He does not know which room his mother is lying in, so he asks a woman sitting behind a counter at the entrance of the ward. The woman is not a nurse, but works in the ward's office. Hence she doesn't have any nursing responsibilities in the ward. Unable to locate a nurse, she picks up a list from her pocket. At the ward they call this list the patient-list. It is a sheet of A4 paper; listing all admitted patients arranged after which room they are lying in (among other things). A quick look at the list tells her that the boys mother is laying in room 10, bed 4. She tells him and he starts walking down the hallway looking for room number 10.

What does not come out of this story above is that the list actually is made for, and used by nurses. During each night watch, a software program assembles a new list. The process of assembling is actually accomplished as an interaction between a nurse and the software program. Although the nurses primarily make the list for themselves, it is actually found usable in other contexts (i.e. office people above). In the example above the list not only structure the practice of handling visitors, moreover it actually exemplify how an artefact produced in one context produces a specific type of organising in another. The list has the power to organize large number of workers (Turnbull, 1993). It is the paper that regulates and coordinates the action that can be taken. E.g. the visitor can find his mother in bed 4 in room 10.

Analysis

The argument in this analysis is as follows. By assuming the stance that organisations do not exist by fiat, we first argue that the organising of work is distributed and emergent by people enacting an organising of work. This paints a picture similar to the pure practice-based approaches. We then turn our attention to

technology and show how technology, when treated symmetrically to people, also enact an organising of work. This shift of focus introduces stability in addition to the temporal character of action, but also the disrupting effect this stability has on how work is organised.

Enacting organising

In the case above we showed that the organising of work is enacted. It is enacted in that the organising ceases to exist when the organising is not performed. As Brown & Duguid (1991) points out: communities do not exist by fiat. Enactment relies on action, and as such is temporary. To make the organising of work durable, the same way of organising must be enacted repeatedly.

We talk of enacting organising instead of people enacting roles. Enacting a role requires the shifting of other people into specific roles and responsibilities. Instead of thinking in terms of a single person enacting a role within an area of responsibility, we see that the enacting of a role requires a shifting of other people: as such, a way of organising work, as in a social activity, is enacted.

The enacting of organising is distributed among the actors. Whether or not to accept being shifted into position is always in the hands of those being shifted. Sometimes they accept, like in the first two episodes above. Sometimes those being shifted refuse, as in the third episode. Organising work can therefore be said to be distributed, which is similar to ethnomethodological point that the organising of work is a collective accomplishment (Barnes 2001).

Technology’s performative capacity

Software technology is often regarded as the enabler of new organisational forms, like geographical distribution, increased inter-organisational cooperation, and knowledge work through knowledge management systems to mention a few. In this view software becomes flexible tools for use by organisations to use as appropriate. Blackler (1995:1032) comments that "it may be better to consider technologies as the medium for organizing itself". Our analysis above corroborates and expands on this view. Technology is not merely a medium for organising, but also actively organising itself.

Latour and Woolgar's (1986) inscription device represents and carries information about the organising of work. They are encoded with ways of organising work. In the Gentoo case we saw that only developers with the right access permissions to the revision control system are allowed to check in new revisions of code. In doing so, the access control mechanisms performs a way of organising wherein only certain developers can do certain tasks. Instead of saying that the revision control system is inscribed or encoded with a particular form of organisation, we emphasise that the task of organising a particular way of working is delegated to the access control system. Wherein encoding and inscription gives

the impression of technology as a passive medium of organising work, our argument is that technology is an active participant in the organising work.

Our analysis focuses on the performative aspect of technology. The term *performative* is borrowed from speech act theory, where "[p]erformative utterances are those speech acts which perform the action the sentence describes" (http://encyclopedia.thefreedictionary.com/Performative%20utterance) like the utterance "I hereby pronounce you husband and wife", for instance. To make the term fit better with the speechless technologies we study, use the word somewhat differently. We see performative as a compound word consisting of *perform* and *formative*. Technology is performative in that it performs, or enacts, a specific way of organising work. Because technology is "precise and repetitive" (Zuboff 1988:8) it keeps performing this way of organising work *ad infinitum* unless changed. As an effect of the reflexive dynamics of computerised systems, Zuboff (1988:9) argues that such systems both automate and informate:

> On the one hand, the technology can be applied to automating operations according to a logic that hardly differs from that of the nineteenth-century machine system–replace the human body with a technology that enables the same processes to be performed with more continuity and control. On the other, the same technology simultaneously generates information about the underlying productive and administrative processes through which an organization accomplishes its work.

It is the latter capacity Zuboff (1988) coins informate. Based on our observation of the performative capacity of technology, we argue that technology in addition to automating and informating also has the capacity of organising work. In addition to seeing how "information technology … is not mute" (ibid.:9), we also argue that information technology is not passive, either. Instead of being a medium for organizing (Blackler 1995) or and as a medium for inscribing knowledge of work processes (Latour & Woolgar 1986), technology actively organises work through its performative capacity.

Technology as constitutive and disruptive

Organisations battle strong centrifugal forces. That is why Schein (1972:15) argues that overall coordination, the integrating function, is required: "If each unit pursues its own self-interests and disregards the activities of other units, coordination has by definition broken down". Without overall coordination, the organisation will succumb to the centrifugal forces and be torn apart. Through its organisational hierarchy the organisation makes sure that all its parts work towards the same common goal. The hierarchy is in place to ensure that every role is acted out according to its area of responsibility. Fighting the centrifugal forces therefore befalls the hierarchy of authority.

The above argument reduces the overall coordination, or the policing of a certain way of organising work, to being a purely human activity–the glue that keeps the organisation from falling apart, is social. Our use of technology's performative capacity, however, we argue that this glue is socio-technical. While the physicians and nurses in episode #3 police a certain way of organising at the ward, technology does the same job in episode #5. In the latter episode it is the access mechanism that actively organises work, enacting an organising of work between developers and their project manager. In much the same way as Latour (1992) argues the task people passing through walls as delegated to the door, we argue that the task of policing a particular way of organising work is delegated to technology in our cases.

Conclusion

This section concludes the paper. Based on the analysis above, we first draw three implications of our analysis. We then end the paper by pointing at future work.

Implications

The analysis above allows us to trace out three implications: a theoretical implication and two methodical implications for the study of work. We start with the theoretical implication, as it forms the basis for the two latter:

Following from our use of the inscription device, the approach to our analysis is to treat the organising of work as a particular case of ordering a network of actors. In so doing we argue that stability in who does what and how does not exist, apart from when it is made to exist. Stability is achieved when the network is identically ordered over time. Order, as the science and technology studies literature teaches us, is only temporal and achieved through an ongoing effort. Our argument is that technology is one of the actors that have a stabilising effect on the network, and that is how we can understand how structure is embedded in situated practice. The ordering of technology is also temporal, but as long as technology remains in the network it will continue to work for a particular way of ordering the network.

There has been raised critique against this way of viewing networks (Berg & Timmermans 2000), arguing that by producing order out of disorder is a process of writing the disordered out of the account. In the ordering those actors falling outside are rendered invisible, given no analytical power. We have tried to be sensitive to this critique like in episode #5 where we show how the ordering within the network produces overflow which manifest itself in alternative work practices.

The second implication is methodical, and related to the theme of this conference. Fox (2000:858) observes that "the theoretical difficulties with early COPT was how to look at practices, which essentially include a temporal element, like action and activity, within a context of wider and relatively stable social

structures". We did an informal survey of the papers published in C&T 2003's proceedings. We found that practically all of the papers in the proceedings treat the communities studied as analytically pre-given. Following up on Fox (2000)'s critique of COPT's treatment of practise as theoretically pre-given, we amend it by argue that neither practice nor communities can be treated as theoretically pre-given. As Barnes (2001:17) comments, instead of specifying "what distinguishes members of a culture of collective from outsiders", one should instead ask how communities come to exist. By focusing on action, we examine how ways of organising are produced through explain the emergence of both roles and responsibilities (the community) and its practices. In this paper we have in our small way started on the work towards one possible approach to unpack the dynamics of how communities and practice are emergent.

The second implication is that technology does not only play a supportive role to work, but is formative to the way work is organised. It is our observation that few papers within the field of computer supported cooperative work are explicit on how technology shapes communities. This leaves the complex dynamics between technology and organisation of work untouched. We find that explanatory power is usually given descriptions of communities reduced to their constituents, members and functional descriptions of technology used, when indeed the question begging to be explained is how a community comes to be. Instead of giving the constituents explanatory power through their existence by fiat, the question is rather how the constituents came to make up a community.

Future work

Ellingsen & Monteiro (2003:203) argue that "sediments of historically superimposed layers of knowledge representations need to be enacted through selective repetitions, omittance and highlighting to preserve it as 'living' knowledge". In this paper we have shown how roles and responsibilities do not exist by fiat. They are continuously enacted. In our studies we find similarities between how Ellingsen & Monteiro's genealogy of knowledge representations, and how roles and responsibilities are moulded and crafted through repetitions and thereby creating a genealogy of historical sediments of the responsibilities of a role. Wherein we studied emergent ways of organising work as the overflow from ordering activities in this paper, future work will further explore the emergence of ways of organising work in terms of a genealogy of enacting forms of organising.

We note in this paper how technology polices certain forms of organising work. To further answer the question of how ways of organising are kept stable over time, future work will further explore mechanisms of policing ways of organising. This involves power, an issue that is implied in this paper, but needs to be more clearly addressed in future work.

References

Barnes, B. (2001). *Practice as collective action*. In Schatzki, T.R., Cetina, K.K. & von Savigny, E. (Eds.), *The practice turn in contemporary theory* (pp.17-28). London and New York, NY: Routledge.

Berg, M. (1999). *Accumulating and coordinating: occasions for information technologies in medical work*. Computer supported cooperative work, 8: 373-401.

Berg, M., & Timmermans, S. (2000). *Orders and their Disorders: On the construction of universalities in medical work*. Configurations 8: 31-61.

Blackler, F. (1995). *Knowledge, knowledge work and organizations: An overview and interpretation*. Organization Studies 16(6): 1021–1046.

Brown, J.S. & Duguid, P. (1991*). Organizational Learning and Communities-of-practice: Toward a Unified View of Working, Learning, and Innovation*. Organization Science 2(1): 40-57.

Brown, J.S. & Duguid, P. (2001). *Balancing Act: How to Capture Knowledge Without Killing It*. In *Harvard Business Review on Organizational Learning* (pp. 45-60), Boston, Mass: Harvard Business School Publishing Corporation.

Carlsen, A., Klev, R., & von Krogh, G. (2004). *Living knowledge. The dynamics of professional Service work*. New York, NY: Palgrave Macmillan.

Chaiklin, S. (1996). *Understanding the social scientific practice of Understanding practice*. In Chaiklin, S., Lave, J. (Eds.) *Understanding practice: Perspectives on activity and context*. New York: Cambridge University Press.

Cook, S. D. N., & Brown, J. S (1999). *Bridging Epistemologies: The Generative Dance between Organisational Knowledge and Organisational Knowing*. Organization Science 10(4): 381-400.

Ellingsen, G. & Monteiro, E. (2003). *Mechanisms for producing a working knowledge: Enacting, orchestrating and organizing*. Information and Organization 13. 203–229

Fetterman, D.M. (1998) *Ethnography*, Second edition. SAGE Publications, Thousand Oaks, CA.

Foucault, M. (1972). *The Archaeology of Knowledge*. New York, NY: Harper and Row,

Fox, S. (2000). *Communities of practice, Foucault and actor-network theory*. Journal of Management Studies 37(6):853-867.

Hong, L.K., Duff, R.W. (2002). *Modulated Participant-Observation: Managing the Dilemma of Distance in Field Research*. Field Methods 14(2,):190–196. Sage Publications

Hutchins, E. (1991). *Organizing work by adaption.* Organization Science 2(1): 14-39.

Hutchins, E. (1995). Cognition in the Wild, Cambridge, MA: MIT Press.

Klein, H.K. & Myers, M.D. (1999). *A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems*. MIS Quarterly 23(1): 67-94.

Latour, B. & Woolgar, S. (1986). *Laboratory Life: The Construction of Scientific Facts*. Princeton, NJ: Princeton University Press.

Latour, B. (1992). *Where Are the Missing Masses? The Sociology of a Few Mundane Artefacts*. In Bijker, W.E. and Law, J. (Eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change* (pp.225-258). Cambridge, Mass.: The MIT Press.

Lave, J, & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Levitt, B. & March, J.G. (1988). *Organizational Learning*. Annual Review of Sociology 14:319-340.

Orr, J.E. (1996). *Talking about machines: An ethnography of a modern job*. Ithaca, NY: ILR Press.

Polanyi, M,.(1966). *The Tacit Dimension*. London: Routledge and Kegan Paul.

Robbins, D. (2003). *Gentoo Top-Level Management Structure*. http://www.gentoo.org/doc/en/management-structure.xml. Accessed November 15 2004.

Schein, E.H. (1972). *Organizational Psychology*. New York, NY: Prentice-Hall.

Star, S.L. & J.R. Griesemer (1989). *Institutional Ecology, Translations, and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology*, Social Studies of Science, 19:1907-39.

Suchman, L. (1987). *Plans and Situated Action: The Problem of Human-Machine Communications*. Cambridge: Cambridge University Press.

Tjora, A. (2002). *Aksjonskollektivet: Samarbeid og bruk av teknologi i akuttmedisinsk koordinering*. Trondheim: G-Academy, 137 s.

Turnbull, D. (1993). *The ad hoc collective work of building Gothic cathedrals with templates, string and geometry*. Science, Technology and Human Values 18(3): 315-340.

Zuboff, S. (1988). *In the Age of the Smart Machine: The Future of Work and Power*. New York, NY: Basic Books.

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.