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Making Materials Matter—A Contribution to a Sociomaterial Perspective on Work Environment

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ABSTRACT

This paper aims to discuss the implications of adopting an STS (science and technology studies)-based conceptualization of the psychosocial work environment. We problematize how work environment research presently divides elements of working conditions into separate physical and psychosocial dimensions. Based on actor network theory, a currently dominant perspective in the field of STS, we discuss the concept of sociomaterial work environment. An ANT perspective on work environment is relevant and timely, we argue, first and foremost because more entities are embraced in the analyses. We argue that the ANT perspective leads to a more nuanced understanding of the work environment where it is not a set of predefined categories that is the focus of interest, but rather the work environment as multiple locally performed aspects of agency, translation, and collectively constructed reality. This perspective on work environment, we argue, addresses pivotal issues raised in the work environment debate during the last ten years, for instance of how the work environment as a concept saliently belongs to a social democratic Scandinavian agenda in which the singular employee in a work environment context is predominantly seen as a victim. This trope, which was peaking in the 1970s, is increasingly becoming obsolete in a changing economy with still more flexible jobs. The contribution of this paper is to provide a presentation and a discussion of the potentials and pitfalls provided by a shift toward a sociomaterial work environment perspective, as well as an empirical exemplification of a sociomaterial approach to work environment assessment.

KEY WORDS

Actor network theory / assessment / intervention / psychosocial work environment / sociomateriality / sociotechnics / stress / subjectivity / working conditions

Introduction[1]

This paper discusses the concept of psychosocial work environment based on the dominant perspective within science and technology studies (STS), namely that of actor network theory (ANT). The purpose of introducing this discussion is to emphasize the importance of organizational, technological, and material aspects for emergence of psychological well-being and stress. The work environment research presently inadequately

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divides elements of working conditions into separate physical (ergonomic, chemical, etc.) and psychosocial (support, job control, rewards, etc.) domains. In order to reassemble those domains we argue that the notion of sociomaterial work environment is a fitting alternative. Firstly, we expand the concept of "psychosocial work environment" in order to include a wider range of phenomena. Secondly, we propose and critically discuss an alternative to the dominant paradigm of assessment and intervention in the work environment research. Thirdly, we argue that the dominant paradigm of assessment and intervention may lead consultants and practitioners to address complex problems with simple standardized solutions. The paper scrutinizes three aspects of ANT: generalized symmetry, assemblage, and the making of subjectivity. We posit these as central to the construction of a sociomaterial perspective on psychosocial work environment. These three aspects underline ANT as a sociomaterial perspective; a perspective focused on the hybrid relations between human and nonhuman actors; and finally as a perspective criticized for ignoring human experience while simultaneously illuminating novel aspects of subjectivity. In order to examine these notions and demonstrate their usefulness in providing a novel understanding of work environment, we apply them to a case study of postal service mail deliverers' work environment. From explorative interviews analyzed with a framework based on the aforementioned theoretical concepts, we examine what novel aspects of work environment are identified using this approach and discuss how the concepts of symmetry, assemblage, and subjectivity can foster new understandings of work environment, and how the dominant conceptualizations can thus be challenged.

We are aware that this shift in vantage point can increase complexity, potentially posing problems for planning and implementation of even simple work environment interventions. The contribution of this paper is thus to offer a presentation and a discussion of the potentials and pitfalls provided by a shift toward a sociomaterial work environment perspective, as well as an empirical exemplification of this approach to work environment assessment. One might argue that other complexity-sensitive approaches such as symbolic interactionism (Blumer, 1986), discourse analysis (Fairclough, 2003), or grounded theory (Glaser and Strauss, 1980) might be equally relevant as a means for revitalizing the work environment concept. We chose ANT as a framework, as this approach fosters sensitivity to contextual complexity while also emphasizing the link between social and material aspects of workplaces. Though a number of Scandinavian work environment studies have already used ANT analytic strategies (Bramming et al., 2012; Mogensen, 2012; Nickelsen, 2008, 2009; Olesen et al., 2011), we see the need for a more encompassing discussion of the division of the work environment research into separate domains, and in particular the specificities of applying ANT analyses to work environment assessment and intervention.

We start by presenting a brief account of the theoretical positions that have influenced the field of psychosocial work environment. We include the history of the concept of psychosocial work environment to emphasize which traditions of thinking this paper challenges.

Psychosocial work environment

The concept of "psychosocial work environment" has roots in several scientific paradigms and draws on various disciplines (social psychology, psychoanalysis, sociology,

biology). Two schools of thought have been particularly influential from very different ontological points of departure: one being the sociotechnical school (Dartington, 2010), and the other the physiologically oriented stress research school (Karasek and Theorell, 1990; Selye, 1950). The sociotechnical school comprises an attempt to integrate goal-rational intentions with psychological satisfaction. Miller and Rice (1967) present it as an open systems perspective drawing on group analysis (Bion, 1961) and system theory (Bertalanffy, 1975). The purpose is to construct a theory of work organization as dynamics between groups of people in organizations, as well as to focus on boundaries between work organization and technology:

> *'The concept of socio-technical system arose from the consideration that any production system requires both a technological organization, equipment and process layout, and a work organization […]. The technological demands place limits on the type of work organization possible, but a work organization has social and psychological properties of its own that are independent of technology'* (Rice, 1958, p. 4)

The ambition is to integrate work organization and technology, to increase both job satisfaction and production output at the same time. As a testament to the link between Scandinavian work environment research and the sociotechnical school, several of the Scandinavian participatory industrial experiments, including the introduction of work groups and job rotation at the Volvo plants in Sweden, are presented in a separate central chapter in the hitherto most ambitious presentation of the social psychology of organizations (Katz and Kahn, 1978). A central premise in the sociotechnical school of thought is that participation and collaboration is necessary in order to make workers content and productive at the same time. One of the most cited examples of a sociotechnical intervention is the expansion of mining sections in a British mine, the introduction of so-called long-wall mining method (Trist and Bamforth, 1951), which led to both increased productivity and well-being. A central concern in the sociotechnical school revolves around sentient boundaries, which is argued to be a relation between the technical-rational and the psychosocial aspects of the organization that the workers accept and find adequate (Miller and Rice, 1967). As formulated by Miller and Rice: "*A sentient system or group is one that demands and receives loyalty from its members*" (Miller and Rice, 1967, p. 259). The perspective sees organizations as comprising of different spheres. In order to achieve satisfaction and efficiency, workplace democracy, task variation, and wide-ranging participation are employed as tools to coordinate the spheres. The sociotechnical perspective does not have the same prominent position today as it had in the sixties, seventies, and eighties. Aspects of the paradigm still heavily influence contemporary work environment research, where participatory intervention strategies are widely used to improve working conditions and reduce stress (Nielsen et al., 2010). A review of current major European methods to improve psychosocial work environment revealed that communication and efforts to improve a collaborative climate are still central elements in all the methods (Nielsen et al., 2010).

Another quite different, but equally influential, paradigm is the stress research school, conceptually building on the discovery by Hans Selye of the generalized stress response. He discovered that putting mice under strain from various environmental factors led to a similar negative health outcome (Selye, 1950). This function has been labeled "general

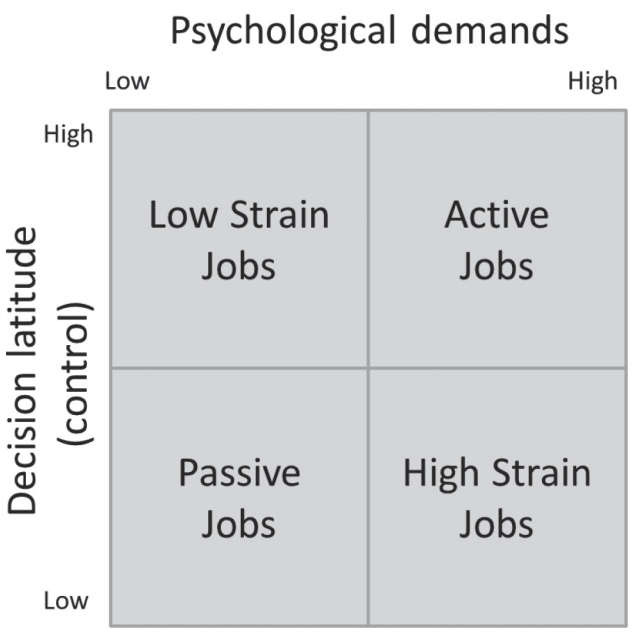
adaptation syndrome" and sets the foundation for further research in what types of exposures are stressors and how they cause stress and adversely affect health.

Several aspects of this early research are important for present day stress perspectives. The cognitive psychological research on "coping" (Lazarus and Folkman, 1984) can be seen as an example of how the reduction of adverse effects of psychosocial work environment can be conceptualized as a distinct psychological project. Here it is the cognitive response to the environment that is seen as the cause to stress, and a suitable coping strategy will therefore reduce the strain significantly.

Another tradition emerging from the stress research tradition is the model building approach aiming to create explanatory models of how working conditions cause stress. Karasek and Theorell's "psychological demands/decision latitude model" (Karasek, 1979; Karasek and Theorell, 1990) also known as the "demand/control model" (Van der Doef and Maes, 1999) is widely used as a basis for operationalizing the psychosocial work environment (Agervold, 1998; Graversgård, 1998; Wegman and Hogstedt, 2007). The model operates in its original form with two aspects of jobs, namely psychological demands and decision latitude (see Figure 1), and has later been expanded with the social support dimension (Johnson and Hall, 1988; Karasek and Theorell, 1990; Skakon et al., 2010).

It is the simplicity that has made this model so popular; its immediacy and the pressing argument that low control and high demands increase the risk of suffering from cardiac disease. The model embraces in its original form an argument for a job market with healthier jobs and more well-being (see Karasek and Theorell, 1990,

Figure 1: The psychological demands/decision latitude model (Karasek and Theorell, 1990, p. 32).



pp. 276–334). This aspect of the demand/control model builds on the Swedish experiences with workplace democracy and the arguments from the sociotechnical school that participation and productivity are linked. This aspect of the theory is however not included when Van der Doef and Maes (1999) in a retrospective paper look back on the 20 years of the demand/control model. The gradual omission of this aspect makes the model appear to consist of two generic dimensions, with the proven hypothesis of these two factors being the most relevant factors in every job to assess the risk of stress and psychological work-related harm.

The widespread use of the model is evident in both research and practice in Scandinavian countries (Danish Labour Inspectorate, 2003; Graversgård, 1998; Kristensen, 2002; Pejtersen et al., 2010; Wegman and Hogstedt, 2007). A specific example of how the demand/control model is used in a Scandinavian context is the choice of scales in the Copenhagen Psychosocial Questionnaire (COPSOQ) (Kristensen, 2002; Pejtersen et al., 2010). This widely used and translated questionnaire draws on both the demand/control model, the vitamin model (Warr, 1987), the effort reward imbalance model (Siegrist, 2002), as well as several coping frameworks such as Antonovsky's (1987) sense of coherency. A common denominator for these perspectives is that they revolve around constructs assumed to be highly important to psychological well-being regardless of vocation, site, or type of employment. The apparent universality facilitates comparisons between employees, work units, companies, sectors of employment, and countries, while aspects that are diverse, innumerable, and incomparable are overlooked.

This brief historical view of the paradigms that have formed our understanding of psychosocial work environment demonstrates the diversity that characterizes the field. The stress-based approaches have a strong position in Scandinavia, and the sociotechnical school has clearly influenced our thinking of what constitutes organizational psychology. Du Gay and Vikkelsø (2012) and Mogensen (2012) all criticize the lost specificity in recent organization studies. They find the classical sociotechnical notion of primary task to be of continuous importance, and argue that by focusing on the primary task, the social and technical spheres are collected. In spite of this attempt to revitalize the notion of primary task, a common feature of the presented perspectives are that they accept and operate with separated spheres of work organization and technology which follow different logics. The implication of this thinking is predefined positive aspects of the work organization (control, development, meaning, democracy, participation), as well as a priori negative aspects of work organization (high demands, monotony), which one wants, respectively, to enhance and diminish.

We see these as fairly narrow standards for how the psychosocial work environment is articulated, and hence how it is assessed and acted upon. The consequence is that psychosocial work environment is constructed as a normative field consisting of a series of pre-established concepts (control, influence, democracy, stress, monotony). This undoubtedly leads to an exclusion of nonstandardized areas and effects. The divide between what is conventionally considered "work environment" and the problems experienced in contemporary less regulated jobs has led to a problematization of the mere notion of "work environment" (Allvin and Aronsson, 2003). Where the traditional paradigms of work environment research predominantly presume stable jobs, Allvin and Aronsson (2003) express concern that flexible jobs seem to be without a work environment (in a traditional sense) but none the less pose psychosocial risks:

> *'The concept of work environment, as we have maintained, presupposes work as relatively well-defined and located within a relatively well-defined set of circumstances that are subject to an established order of negotiation. Since this is no longer the case with a growing number of jobs, we should expect the field of possible conceptual applications for work environment issues to be shrinking.'* (Allvin and Aronsson, 2003, p. 109)

To accommodate to this new reality we propose a shift toward a radically different approach to conceptualizing "work environment," namely a sociomaterial approach.

Science and technology studies

The field of STS developed from efforts to understand knowledge production in areas of science and technology. STS is not in itself a clearly defined theoretical perspective but rather a number of methodical orientations which in different ways are inspired by relational philosophy and on that account frame the studied phenomena as being situated, distributed, complex, and largely sociomaterial. We specifically build on concepts from the tradition labeled ANT, which is one of the most used theoretical frameworks in the field of STS.

Drawing on the ANT literature we support the notion that researchers should avoid forcing their presumptions onto the area of research and should remain open and interested in how human and nonhuman actors assemble and change over time (Latour, 2005). Though the term "actor" is part of the abbreviation ANT, a more precise term is "actants" understood in the ANT frame of material semiotics (Akrich and Latour, 1992; Latour, 1992a; Law, 2008) as an entity that has an effect on the expression of an assembly of elements. ANT analyses thus involve a radical expansion of what researchers should devote their attention to. When studying work environment it is not only specific concepts such as cortisol, stress, back pain, monotony, well-being, or bullying that are considered significant and interesting. Instead focus is on all the actants, the entities which participate in the production of the observed effects. The focus in this article is not a discussion of the foundations of ANT (for such a theoretical review, see Blok and Jensen, 2011; Latour, 1999a; Law, 2008; Law and Hassard, 1999), nor a critical discussion of ANT (for such critique, see Amsterdamska, 1990; Bloor, 1999; Collins and Yearly, 1992; Schatzki, 2002; Whittle and Spicer, 2008). The contribution of this paper is rather a discussion of the potentials and barriers of expanding work environment analyses, assessment, and intervention in accordance with the principles of ANT.

We present some of the important vocabulary of ANT used in this paper, namely "generalized symmetry" and "assemblage," and on this basis unfold and critically discuss some of the problems of addressing human well-being (here articulated as subjectivity) in this paradigm.

Generalized Symmetry

A central element of ANT that we build upon is the notion of generalized symmetry. ANT researchers suggest that the normally dichotomous poles "nature" and "culture" are not separate, but interwoven and need to be explained concurrently (Latour, 1993).

The social, technological, biological, etc. is in other words co-produced (Latour, 2005). The doctrine of generalized symmetry can best be described as a radical methodological ambition to avoid assuming a distinction between the social and material, the human and the nonhuman. The principle has far-reaching consequences for conducting sociological, anthropological, and social–psychological research in general, and work environment research in particular.

The researcher, following generalized symmetry, should avoid giving primacy to any a priori arena of reality and instead adopt a historical and ethnographically sensitive method where actants are followed in the relations they form in material-semiotic networks. By addressing psychological effects (stress, burnout, etc.), as well as physical effects (such as arthritis and tendonitis) from the perspective of generalized symmetry one is to assess what actants (human or nonhuman) participate in the production of these embodied effects. By avoiding the current and generally agreed upon causalities, one might uncover how extraneous elements participate in the production of those effects. In line with the principle of generalized symmetry, Wanda Orlikowski (Orlikowski, 2007, 2010; Orlikowski and Scott, 2008) has stressed the necessity of focusing on the "sociomaterial" aspects of organizing. She argues that we need to focus on the entanglement of many diverse areas of organizational life. Through the notion of human-centeredness she poses a necessary critique of the general absence of technology and materiality in organization studies. This adds to our reason for proposing a shift from psychosocial work environment to the concept of a symmetrical and sociomaterial work environment.

In spite of the doctrine of generalized symmetry, ANT analyses have predominantly focused on the networks emerging around novel technologies (Callon, 1986; Law, 1986, 2002; Vikkelsø, 2003). It is not predominantly studies of human becoming that characterize ANT research. Some of Latour's work can even be read as irony toward the hegemony of psychology and a too heavy reliance on preexisting psychological parameters (Latour, 1992b). By adhering to the concept of generalized symmetry in work environment analysis, previously overlooked areas of, especially technological, character emerge.

Assemblage

The term "assemblage" is a concept appropriated from the visual arts, and refers to artistic works with several dimensions and materials, such as collages. Deleuze and Guattari (1988) introduced the notion of assemblages as the substance of society in "A Thousand Plateaus," a use that has since been taken up by Latour (2005) and others (DeLanda, 2006; Law, 2008). The concept of assemblage has several meanings; it refers to meetings between discursive formations and material practice, and it refers to elements of actors being put together but not forming a unified entity (something concepts such as "class," "group" and "society" would imply). Deleuze and Guattari (1988) indicate that assemblages are ontologically heterogeneous, exist in relation to other entities and assemblages, have effects on other assemblages, and they always consist of, and build upon, other assemblages (DeLanda, 2006).

Deleuze and Guattari present several aspects and forms of assemblages (machinic, abstract, enunciation, etc.). In this paper we, instead of this typology, draw the ANT

position of heterogeneous assemblages as the foundation of social theory (Latour, 2005; Law, 2008). We build on the proposition by Law (2008) that ANT can even be:

> *'…understood as an empirical version of Gilles Deleuze's nomadic philosophy (Deleuze and Guattari 1988). Latour has observed that we might talk of "actant rhizomes" rather than "actor networks," and John Law has argued that there is little difference between Deleuze's agencement (awkwardly translated as "assemblage" in English) and the term "actor network" (Law, 2004). Both refer to the provisional assembly of productive, heterogeneous, and (this is the crucial point) quite limited forms of ordering located in no larger overall order. This is why it is helpful to see actor network theory as a particular empirical translation of poststructuralism.'* (Law, 2008, pp. 145–146)

In this regard the title "Reassembling the Social" (Latour, 2005) refers to how the concept of "society" should be abandoned and the relational concept of assemblages of actants should be the more useful replacement in the social sciences. In all these accounts an important aspect of assemblages is how they are used as a critique of stratified reality. By addressing working conditions as assemblages of actants we propose a radical shift in the ontology of work environment issues. Instead of a layered and categorical ontology, the assemblage position stresses the complex infinite possibilities of how macro, micro, discourse, material, and technological entities can come together and form assemblages across conventional ontological levels; this position has fueled critique by the scholars in the critical realist position (Reed, 1997). Furthermore, critics of the ANT position have problematized how human intentionality is undermined (Pickering, 1993), and how, in its focus on symmetric descriptions of the performed effects of programs and antiprograms, ANT appears Machiavellian and perhaps even sides with the powerful actants (Star, 1991). In light of these criticisms as well as to address human well-being we now discuss the fate of the human subject in a sociomaterial perspective.

Subjectivity

In light of the criticisms of ANT outlined above, it might not seem obvious to include subjectivity as a key element in ANT analyses. However, we argue for investigating the subjectivity involved in the sociomaterial work environment. Moser and Law (1999) have argued how subjectivity is produced in "passages" similar to the "assemblages" described above. They focus on relations between subject, materiality, and competences, and study the assemblages in which heterogeneous elements tie together for a specific person. Inspired by this Nickelsen (2008) describes how standardized systems of production in an industrial setting can lead to disempowered subjects, musculoskeletal pain, and exclusion from the labor market. An employee at the industrial plant in the study is met with repeated strenuous work processes that cause pain; this furthers a construction of the specific employee as an incapable subject in the eyes of engineers and coworkers. The employee tries to get help to accommodate the situation; a technician attempts to develop a support tool for operating the machinery and an engineer tries the production process first hand, and finds it doable for a "normal" subject. The inability to find other more suitable passages eventually forces the employee to leave the company. The main argument of Moser and Law (1999) and Nickelsen (2008) is

how material and corporeal relations are involved in the becoming of the competent, as well as the incompetent, subject.

If the enabling assemblage is in place (strong body, doable task) a competent subject is produced. If, on the other hand, the assemblage fails to be supportive (weak body, strenuous task, musculoskeletal pain) an incompetent or even discredited subject is produced. This argument builds on Star's (1991) wider criticism of standardized systems and the way such systems risk alienating unstandardized subjects. Her argument is that standards create order and convenience for those who have standardized bodies and cause problems and exclusion for those who have nonstandardized bodies. The aberrant subject is thus produced in the meeting between nonstandardized bodies and standardized systems. Certain assemblages are more difficult to pass than others, even though the core trait of a standard is to be smooth, invisible, and passable.

The principle of generalized symmetry demands that the researcher starts out by setting initially perceived differences aside, and remains equally open to all actants. It does not, however, exclude that through the research process one can come to the conclusion that different actants present themselves in different ways. Although still symmetrical and keenly material, since the point of interest is directed toward the sociomaterial work environment, there is a need to let the doctrine of generalized symmetry embrace the subjectivity of psychological phenomena such as well-being. The lack of interest in the human subject has previously been pointed out as the key reason for not employing ANT as a foundation for work life studies (Buch, 2007, p. 84). In spite of this there are several ANT studies interested in subjective becoming (see, for instance, Gomart and Hennion, 1999; Law and Moser, 2003; Mol, 2003).

ANT holds the position that "agency" is seen as distributed in an assemblage and not inherent in human bodies. In the laboratory studies in the 1970s inscription devices were in the foreground (Latour and Woolgar, 1986). In other settings, social, cultural, or psychological phenomena might manifest as most prominent. Hernes (2010) for instance argues for analyzing meaning structures by way of ANT analytical strategy. He claims that even though one starts an analysis based on generalized symmetry and upholds the same attitude toward all actants, one will often discover how human actors ascribe significance and meaning to not only other actants, but also to collectives of actants beyond their immediate scope. This cognition about actants is of course impossible for material actants. Hernes explains how this asymmetry is still viable in an ANT setting:

> *"Although ANT insists upon symmetrical treatment between human and non-human actors, however, it does not mean that asymmetry is excluded. It merely means that asymmetry is not to be taken as a starting point of analysis."* (2010, p. 180)

Our point is that the doctrine of generalized symmetry offers the opportunity to focus the analysis on what Latour (1998) calls "person making." According to Latour, person making is an inseparable part of the mutual becoming of subjects and objects. Thus individual phenomenology, agency, as well as collective realities emerge from the specific formation of assemblages. Schraube (2013) argues that although human subjectivity is experienced from the first person perspective it is coconstituted by a number of actants. The human subject is not merely a product of phenomenology, nor of societal discourses, nor is it simply a product of positioning in discourses (Davies and Harré, 1990). We argue the human subject is coconstituted between numbers of heterogeneous actants in

partial connections. This argument and perspective is intended to expand, nuance, and adapt the generalized symmetry, so it is able to conceptualize and encompass human subjectivity as one of several elements produced in an assemblage—not to return to an anthropocentric paradigm.

The theoretical foundation for psychosocial work environment, we argue, is improved by adapting to the analytical sensitivity characteristic of ANT. In order to further illustrate these mainly theoretical arguments we take up a case demonstrating how an ANT analytical strategy can facilitate a shift from "psychosocial" to "sociomaterial" work environment research. At the end of the section we discuss the implications of this shift for the practices of work environment assessment and intervention.

Method

To empirically study the proposed shift toward sociomateriality through the concepts of generalized symmetry, assemblage, and subjectivity we have analyzed a series of structured interviews with employees about what was positive and negative about their jobs. A total of 56 Danish Postal Service Mail Carriers (o*net definition) from four postal districts were interviewed using an explorative interview strategy (McDonald et al., 2004). The interviews were conducted by a trained psychologist at the interviewee's workplace and generally lasted 1–1½ hours. The interviews consisted of a series of statements such as "what makes you want to go to work in the morning," and "what makes you feel tired and worn out at the end of the workday," and the interviewee asked to report which aspects of the work that made him/her feel that way. The responses were written on post-it notes by the interviewer and subsequently placed on a large piece of paper laid out between the interviewer and the interviewee. The interviewee was asked to approve or correct the interviewer's written recollection, thus continuously validating the interviewees' responses. The interviewer would then, while still remaining open toward content, inquire about why the mentioned aspects of work are problematic or positive, what is done to improve the specific aspects of work, and what the employee suggests could be done. These responses would also be written on notes and placed adjacent to the notes they referred to. In this way a complex map was drawn of associations between the social, organizational, material elements of work influencing the specific employee's well-being.

The interview thus produces a visual representation of the perceived actants affecting the mail deliverer. The interviews also illustrate what types of effects these actants have on the mail deliverers, and what other actants are affecting these relations. These interviews are thus ideal to illustrate the sociomaterial stance as they remain open with regard to what aspects of work are included in the analysis. The result of the interviews was an uncovering of a vast number of diverse working conditions. We have selected three of the most prevalent themes in the interviews for further analysis on the basis of them being exemplary to show the sociomateriality of working conditions, and ideal to demonstrate how generalized symmetry, assemblage, and subjectivity can be used as concepts in work environment assessment. We have thus selected material on the basis of commonly occurring phenomena and relevancy for our current endeavor. The advantage of employing the open structured interview method is that we avoid generating data on the basis of our theoretical preconceptions, and instead let the interview

persons describe their experiences of what makes them feel good and bad about their work. These subjective descriptions of work environment issues are both comprehensive and unbounded, making it possible to analyze the occurrence of assemblages of work environment, symmetrical perceptions of people and technology, and sociomaterial subjectivity.

Analysis

The analysis consists of three cases from the work environment of postal workers, focusing on different areas of working life (snow, cars, and route replanning) to illustrate how the ANT concepts apply to work environment analysis. Each highlights the concepts in a different way and exemplifies facets of the sociomaterial approach. The inability to establish homogeneous causality is exemplified in the analysis of heavy snow as a symmetrical assemblage of work environment themes. The subjectivity of work environment is shown in the example of cars where questions of identity and subjective health experiences intertwine with the procurement practices of the postal service and technological specifications of the postal cars. Finally the analysis of postal route replanning illustrates replanning as a collective effort of an assemblage of humans and technology. The relevance of adhering to generalized symmetry in analyzing the work environment of postal workers is likewise exemplified.

The weather as psychological work environment

It is a very reasonable assumption that the weather is a central part of the working conditions of postal workers who spend most of their working hours on the roads in cars and on bicycles delivering mail. What is striking is the way that the weather is a sociomaterial phenomenon entangled in several psychological and organizational venues of the postal work.

Large snow masses were mentioned as a clearly negative factor in almost all interviews. This was no surprise as they were conducted in March 2010, after an exceptionally long and harsh Danish winter. What was eye-opening though were the explanations of why and how the snow was causing distress. We were presented with explanations involving a diverse array of actants; it caused overtime, it made customers angry, it undermined the sense of professional pride regarding getting the job done, it created conflict between employees wanting to continue mail delivery in spite of snow-covered roads and those who argued that safety weighed heavier, it increased risk of falling and getting injured, and steering the car in the snowed roads caused mental exhaustion at the end of work days. With such a diverse list of effects, it becomes obvious that "snow" is not an exclusively physical problem but is best understood as woven together with other aspects such as professional pride, norms, meaning of work, productivity, and safety. By addressing "snow" from the stance of generalized symmetry, and thus treating it as an assemblage related to diverse areas of work, we illuminate the complex and multimodal aspects previously overlooked. Snow is in this sense an actant which, in relation to other actors, is relevant to understanding the sociomaterial assemblages of work environment for postal service mail deliverers. The ANT concept of symmetry encourages us to avoid

a priori judgments about the nature and effect of phenomena such as snow, and facilitates a local re-evaluation of what a phenomenon is, what effects it has, and how these effects are achieved.

Vehicles and their consequences

When continuing the scrutiny of postal working conditions using the general symmetry doctrine, another theme that is evidently sociomaterial is the vehicles in the postal fleet. The theme "vehicles" is not conventionally considered a psychosocial phenomenon, but is instead often seen as a strictly material area. When we look closer to why and how vehicles are perceived as good or bad and adhere to the generalized symmetry to avoid presupposed categorization the sociomaterial aspects become apparent. First off, cars, as a representation of the postal service, are a source of pride that can affect the postal workers.

As an interviewee puts it:

> *'he is under pressure in the repair shop, so he can't fix minor things. Some of the other cars look like bumper-cars. They have dents but it is only cosmetic so it won't get fixed. I still believe that we have a public face and shouldn't drive in those bumper-cars that look like god knows what. My car is very dusty inside, and I know when it gets hot it becomes hazardous. I have tried to do something about it but it's like banging your head against the wall… I want things to be in order and function properly.'*

The visual state of the car here becomes an extension of the postal service. And the boundary between the personal pride in the job and the material conditions for carrying out the tasks becomes blurred. The core subjectivity of feeling like a postal worker, and being proud of participating in upholding a logistical pillar of society, is irrevocably linked to participating in the assemblage of postal delivery together with the materiality (both functional and aesthetic) of vehicles. An assembly of postal delivery containing vehicles in bad shape produces issues of safety, fear of breakdowns in rural areas, worries about ominous engine sounds, and strain from operating manual windows and transmission. The wide-scoped effect of vehicles is illuminated by moving from identifying specific standardized factors to analyzing assemblages of actors.

Conventionally, quasi phenomena such as vehicles would be ignored and forced to be categorized as either material or psychological. That material conditions are assumed by employees as separate from psychosocial work environment is exemplified by one interviewee asking the interviewer whether she is allowed to mention "bicycle bags" as a troublesome aspect of her working conditions negatively influencing her psychological well-being. This illustrates how employees have internalized the material/psychosocial divide, thus obfuscating any cross-modal perceptions of materiality affecting psychological well-being.

A final aspect of vehicles as a sociomaterial element is how the potential of improvements in material conditions are discursively positioned as a psychological source of hope, frustration, and distress. This includes hopes of bikes with electric motors, despair over lack of both common (for Denmark) car accessories such as electric windows and air-condition, as well as wishes for uncommon accessories such as automatic transmission.

'The new cars have electric windows, but not the old ones. We often drive up to a mailbox and need to roll the window down and up again. We do it like, 50 or 75 times a day, right. And I know that some people have been fighting to get electric windows in the remaining cars.'

'We drive out in the countryside where you have these gravel roads, and at this time of year it gets very dusty. And we're sitting in a "greenhouse" with the windows, and you almost need to roll the windows down to stand it, but it's dusting in. And I have some asthma, and I can feel it. Well … air condition in my car would be my highest wish. I have just gotten a new car today, but it doesn't have aircondition [laughs].'

'We do have tinted windows and that takes the edge of the sunlight. I have put black plastic on the, side windows that I'm not looking out of, so they completely block the sun. This makes it less hot in here. But it's because not everybody has asthma and can't stand the dust from the open windows. I don't know if my new car has blacked out windows, or if I need to do something similar there as well.'

As the quote illustrates frustration about a toxic environment in the car becomes a frustration with the postal service's unwillingness to provide solutions, which is then instead temporarily solved with the interviewees "do it yourself" initiatives. Effects of a decision regarding a, conventionally, physical work environment issue (the lack of powered windows) foster a problem in another area (dissent toward buying policies), thus illustrating the assemblageness and sociomaterial character of the work environment. The interviewee's dissent toward his car, his medical condition, and the buying policies of the postal service are in this case facets of the same assemblage of working conditions producing an asthmatic unhealthy subject skeptical of his car as well as his organizations policies. Characterizing the experiences in the quotes as material or psychosocial work environment is impossible. By remaining symmetrical toward the elements mentioned we accentuate how interlinked the aspects of the assemblage are, and how subjectivity of work environment is produced.

The sociomateriality of route replanning

The most complex of the sociomaterial phenomena in the working conditions of postal workers that we address in this paper is the process of replanning the postal routes. As a frequently mentioned work environment issue in the interviews, replanning is only sufficiently understood by moving away from divides between physical and psychological and toward a sociomaterial perspective that integrates these venues through the concepts of symmetry and assemblage.

The reason for needing to conduct replanning at all is distinctly material. Due to an increasing digitalization of the Danish society the amount of mail is steadily declining. This leads to lower revenue and thus fewer postal workers who in turn each need to cover a larger geographical area. This is solved by, roughly annually, replanning the routes. The process of replanning itself is keenly sociomaterial: A computer program (GIS-TOR[2]) produces a layout based on distribution statistics; this layout is then adjusted by the postal workers based on their knowledge of the actual delivery possibilities as some elements of the roads are not accessible in the computer system.

'it's a huge task to replan the routes. GIS-TOR, the system that produces the layout, changes the routes so much that they are unrecognizable. When you know your routes you know how much extra mail you can take [from overburdened coworkers], but with this replanning system it's totally unpredictable. It didn't take reality into account. You had to, for example, walk through a house to get to the backhouse, but you can't just walk through peoples private homes.'

When first introduced the GIS-TOR was solely responsible for planning the routes which led to much dissent and logistical problems. Since then the replanning has become a sociomaterial collaboration between the local postal workers and the centralized GIS-TOR.

'When you see the draft route layout[…] you try to adjust it so it is most logical for everybody and there are as few changes as possible. It is a stress factor, if there are too many simultaneous changes, so I try to minimize the changes.'

Meetings are held to discuss the routes and agreements about transitions are made. While the conduct of replanning in itself is an example of a sociomaterial assemblage at work, the effects of, and sentiments toward, the process illuminate previously ignored aspects of working life that are a part of the sociomaterial assemblage of replanning.

The immediate effect of the replanning is threefold: First of all with the dwindling amount of mail the routes are getting longer to accommodate that a lower number of postal workers need to cover the same area. This increases the pace of work substantially which causes musculoskeletal strain. Second, the replanning forces the employees to relearn their routes and routines of delivery. Local knowledge and familiarity with the entire route layout is seen as central to getting the delivery procedure executed smoothly; in a situation of replanning this familiarity is disrupted.

'It can be a stressful, if there are too many major changes, e.g. if you get a totally new route or ten new places for mail depots. The only general problem I see with changes is our replannings. If your route is torn apart and you get a completely new one, which is suddenly 300 households longer, even though you had a hard time making the delivery in time before.'

Finally a replanning with fewer routes is a clear indication of a need for fewer postal workers and thus casts a looming shadow of future layoffs. The assemblage of replanning is hard to define in conventional work environment terms; it is a change process, an increase in pace, a cognitive challenge, a disruption of routines. From the sociomaterial perspective we argue that there is a need for complex issues, such as replanning of routes, to be treated as such, and not reduced to be a simple matter of psychological, logistical, or material nature. To address replanning and its many effects addressing the effects symmetrically, not giving any of them a priori primacy, and perceiving replanning as an assemblage of phenomena is a vital step in moving away from unimodal reductionism and toward a concept of sociomaterial work environment. Then we will be made aware of its complex effects, and following be able to install measures to effectively lessen its influence on working conditions in a broad sense.

These examples all demonstrate how hard it can be to draw exact boundaries between psychosocial and physical work environment, and that it can be more productive to view work environment issues as heterogeneous assemblages having equally heterogeneous effects. Psychosocial work environment, conceptualized as a product of complex and hybrid relations, is only marginally captured by conventional work environment assessment tools (e.g., questionnaires and checklists), which leads us to argue for the consideration of adopting novel complexity-sensitive methodologies in work environment assessment. On the basis of this, and a number of related studies (Callon, 1986; Latour and Woolgar, 1986; Law and Moser, 1999; Mogensen, 2012; Nickelsen, 2008; Vikkelsø, 2007), we argue for the usefulness of a shift toward the sociomaterial position. We now discuss the implications of adopting this change in paradigm.

Discussion

The consequences of shifting away from a priori fixed parameters (such as "demands" or "social support") toward a sociomaterial perspective of work environment are far-reaching. To focus the discussion we have chosen to be specifically attentive to implications for assessment and intervention.

"Assessment" is a key concept in psychosocial work environment research and practice. It is used as an element of planned work environment improvement projects as well as in the ongoing assessment activities dictated by work environment agencies and is considered a central aspect of the European efforts to improve occupational health and safety (European Agency for Safety and Health at Work, 2008). When adopting a sociomaterial perspective the term assessment and related terms such as measuring and mapping are problematized as these terms too crudely narrow in the identified problem. An alternative strategy for examination of psychosocial work environment may be based on Latour's (2005) proposed shift from a "sociology of the social" to a "sociology of associations." Assessment in a sociomaterial perspective, as demonstrated in the analysis, suggests an emphasis on studying associations between actants instead of searching for the work environment as a separate aspect of the workplace. The study of work environment by way of associations focuses on how actants create, change, and sever relations, and how the mass of relations affects the functioning and stability of a workplace. This type of assessment is an explorative task to examine well-being and work environment in that particular setting. The shift toward associations is not a means to simplify assessment of psychosocial work environment, but instead a way to open new areas of scrutiny that are traditionally overlooked because of the predefined parameters. It is also a means to avoid a fruitless search for the causes of a problem and instead identify a circulating reference among entities under scrutiny (Latour, 1999b). Many of the elements of the analysis (snow, air-condition, dust, replanning software) would not even be considered in conventional work environment assessment, whereas the sociomaterial assessment illuminates these heterogeneous actants and the distress their participation in postal delivery produces in employees.

The traditional use of the term assessment is not only partial, but also self-fulfilling. In the choice of assessment methods and area to be assessed, some aspects of the work are bound to be highlighted and other aspects of organizational life are bound to be overlooked as they are outside the scope and means of the method chosen. By choosing

a method and conducting an assessment, you participate in the production of reality and thus are already intervening (Vikkelsø, 2007).

Intervention is, in a work environment research context, an overarching label for the (mainly) planned activities set in motion to improve employee well-being. In a sociomaterial perspective reports, graphs, practice recommendations, action plans, etc. are seen not just as tools for shedding light on the work environment, but instead as actants with the capacity to affect other actants. The existence and circulation of, for instance, work environment statistics or executive summaries (Vikkelsø, 2007) amounts to an intervention in itself. All work environment assessments hold performative potential, as they play a role in defining what is understood by "work environment." These attributions of meaning are producing the local understanding of generic terms as social support, well-being, monotony, possibilities for development, etc. In other words, an assessment contributes to the production of a reality in accordance with its normativity and method.

Based on this, and other related lines of argumentation, ANT researchers have explicitly criticized the plan-rational model of dissemination. As an alternative Latour (1986) suggests a translational model of change, which stresses that all attempts to change social systems consist of a substantial amount of footwork, negotiation, and persuasion. The series of negotiations are fragile, sluggish, and resemble a chain of translations, adaptations, and struggles. Building on this foundation Vikkelsø (2007) points to problems researchers and practitioners face when invited into these struggles by one party to suppress or break another party's resistance. Vikkelsø points out that analyses, rapports, and executive summaries are capable of causing effect comparable to planned interventions. Likewise Bruun Jensen (2007) differentiates between intervention as a necessary and indivisible part of working in the field of psychosocial working conditions, and on the other hand intervening "on purpose." As already mentioned, whether intentional or not, an assessment of work environment factors will have interventionistic effects. Because of this it must be made clear what one wants to achieve as when participating in the work environment of a company, and furthermore one must tread lightly and consider which participants and constructions of reality are empowered and which are marginalized by the intervention of professionals (Star, 1991). When intervening in work environments is seen from a sociomaterial perspective, the symmetry, assemblageness, and subjectivity make it obvious that any attempt to improve psychological well-being in workplaces is conducted on normative foundations. In this entangled reality a work environment professional will never be able to fully anticipate the effects of the change initiatives one sets in motion. Nickelsen (2009) points to how professionals/researchers are not entering neutral settings but instead highly hybrid and politicized contexts. One is met by numerous agendas, and thus by several parties with a potential interest in crafting alliances and enrolling the work environment professional to further their own goals. Nickelsen suggests that to conduct interventions in hybrid work settings is in many ways analogous to seduction. These seductions revolve around defining what the goal of the intervention is. Czarniawska (2001) describes a similar contingency. She claims that the position as a constructionist consultant can make it difficult to be helpful in practice as the fluid and nuanced ontological and epistemological foundation sometimes will face a rigid representation-logic in the field studied, where much is at stake and powerful forces have set interests.

As these studies illustrate, the use of concepts such as symmetry, assemblage, and subjectivity is not necessarily making it easier to reach a unanimous simple conclusion

about a work environment issue. The alternative position we are advocating is to avoid having the work environment professional reduce the complexity of work environment issues, and instead step into the field of hybrid relations and take the role of advocate for the work environment. This shift suggests moving from focusing on work environment as an isolated aspect to seeing it as interwoven with other aspects of organization such as politics, production, management, legislation, and norms. At the same time it becomes obvious why it has limited effect to intervene against a work environment problem conceptualized as a parsimonious phenomenon. By moving away from the traditional perspectives of psychosocial work environment, it is illuminated how material factors are contributing to the psychological problem in question (as shown in the examples of snow, vehicles, and replanning). Interventions in a sociomaterial and symmetrical perspective are seen as actants, continuously enrolling employees, managers, and other relevant actants in an assemblage promoting work environment improvements, thus engaging in collective construction of a certain work environment reality. This perspective on interventions underlines the importance of acknowledging the interests and subjectivities affecting the work environment while also highlighting the demanding and fragile work necessary to stabilize the work environment, create support, momentum, and effects.

Based on the analysis this would include intervening upon the assemblages of postal workers, cars, routes, politics, and weather to make the relations between aspects less strenuous for the postal workers.

The sociomaterial perspective on work environment we have presented and discussed in the present paper leads to a number of implications; it makes a difference to adopt a sociomaterial perspective on work environment instead of adhering to a traditional perspective where concepts as stress, support, demands, and control are a priori assumed to be the most important. The symmetrical perspective stresses the performativity inherent in theories and methods and the complexity involved in work environment issues, and it acknowledges the massive amounts of negotiation and footwork needed to make work environment changes happen.

Conclusion

We have stressed the importance and relevance of a sociomaterial perspective on work environment in the theoretical discussion and in the case analysis. The aim of the paper is to critically examine the potentials of an STS perspective—more precisely an actor network theoretical perspective on psychosocial work environment. Firstly, the way work environment is conceptualized hugely affects how assessment and intervention is carried out. Secondly, we argue, there is a need to revitalize the work environment concept using complexity-sensitive theories that more thoroughly embrace organizing, power, temporality, spatiality, and materiality. Symmetrical and sociomaterial analyses radically extend the scope of actants deemed to coconstitute the work environment. What we suggest is a move from generic concepts such as "demand," "control," "participation," "empowerment," and "stress" to consider actants of all sorts to be potentially contributing to the assemblage of work environment. Our argument continues; with this expansion of actants follows a likewise broadening of the possibilities of intervention. We have offered several examples of how sociomaterial analyses can lead to the uncovering of new and

unexpected problems and conflicts originating in multiple modalities. By addressing these issues, a more nuanced, contextually specific understanding of work environment as well as intervention is appearing.

Although we are advocating for this position it is not without problems. We acknowledge that simple generic models may sometimes provide clear directions for action, especially with regard to mobilizing and sustaining support from politicians, administrators, etc., while complex theoretical analysis in the worst case may be deemed esoteric and unrealistic and thus jeopardize the milestones made in work environment legislation and practice. In other words, sociomaterial analyses run the risk of shifting attention away from the key issue at hand, namely improving the well-being of employees at work, creating safe and good workplaces, and prosperous working lives. On the other hand, we have argued that sociomaterial analyses may open the possibility of new understandings and also provide the possibility for new kinds of intervention. To efficiently tap this resource, sociomaterial analyses have to be further tested, adapted, and developed specifically for work environment purposes. Latour argues that psychosocial and technological realities are created simultaneously and through the same processes. We find this intriguing. However, though we value Latour's writing we want to stress that humans think, have feelings and intentions, and create meaning, attributes that machines have (not yet) acquired. Even though Latour (1992a), pointing to speed bumps and door grooms, argues that nonhumans possess some sort of intentionality, we feel the need to allow room for matters of phenomenology when operating in the work environment field. In this paper we have suggested that it is possible to grasp work environment issues related to well-being and human subjectivity in a sociomaterial frame. Our conclusion is that ANT, as a basis for sociomaterial work environment studies, holds great potential, but that the doctrine of generalized symmetry needs to be recalibrated to match the work environment research agenda. Normative psychological concepts such as well-being are not incommensurable with ANT, but the combination is not straightforward either. In an ANT perspective matters such as phenomenology, human sensitivity, emotionality, and sense-making, i.e., well-being, simply present themselves as effects or inscriptions mediated through discourses, graphs, surveys, and interview summaries.

Finally we want to accentuate the paradox that work environment is a politically regulated normative research and practice field, whereas ANT builds on an equally descriptive, neutral, and open ontology. Based on this crucial difference the researcher/practitioner needs to make his/her normativity explicit and describe the assumptions about work environment inherent in the methods used in a given intervention or study. We believe this has great potential since the unquestioned established traditions and normativities in the work environment research field may be challenged, and renegotiated. Summing up, the primary advantage of the sociomaterial perspective is that attention is shifted toward the assemblages through which well-being, or the lack thereof, is constructed as more or less unquestioned truths. Throughout the paper, we have argued that it is innovative to direct the analytic focus toward heterogeneous assemblages. According to this perspective we have also highlighted the massive effort and the minute negotiations necessary to induce change. On a final note we want to encourage more research about the role of human subjectivity and well-being in ANT as well as in the broader field of STS. This research has the potential to further work environment research, ANT, and STS.

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End notes

[1] The submitted article draws to some extent on a translation of the following article published in Danish:
Abildgaard, JS, Nickelsen, NCM & Bendixen, M 2012, Contribution to a Symmetrical and Sociomaterial Perspective on Work Environment (Original Danish Title: Bidrag til et symmetrisk og sociomaterielt arbejdsmiljøperspektiv), Tidsskrift for Arbejdsliv, 14, 3, pp. 57–76.

[2] Geografisk Informations System/Tur Og Ruteplanlægningssystem (English: Geographical information system/shift and routeplanning system).