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Complete Research

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Abstract

This article uses a case of oil and gas exploration as the starting point for methodological considerations in the study of sociomateriality. I argue a sociomaterial research continuum ranging from "hard" to "soft" sociomateriality depending on how the technology-human relationship is conceptualised in the literature. In the hard end, there can be no understanding of the one without the other, while contributions towards the soft end of the scale accept a conceptual distance between them, although claiming symmetry. The hard version is under critique for using unclear language and producing confusing levels of analysis, and the soft version has been critiqued for not properly addressing macro level influences. The case is critical in that it illustrates the problematics of sociomateriality, being saturated of data and IT tools that are both necessary for the process to work and produce outputs that without these same tools would be very different. There is in other words symmetry performed. I answer the call to not reside to simplified and single scholarly approaches and use relevant discussions and insights from science studies, sociology and organisational research to suggest that the issues discussed in sociomateriality transcends the debate between critical realism and agential realism going towards the core of scientific questions of the relationship between the subjective and the objective and between data and theory. I find that the consequence of this is that sociomaterial research must cut across ontological, epistemological and methodological borders to embed the notion of performativity and not impose a-priori ontological barriers, but rather ask questions that allow us to construct concepts that are applicable in our empirical analysis. I suggest that sociomateriality in addition to commit to subtle realism should glance to conventionalism and pragmatically consider the applicability of the concept without the potential restrictions imposed by claims of truth. Sociomateriality is, it seems, in the constructive process of exhausting epistemological obstacles by a necessary consideration of existing concepts (found in agential realism, socio-technical and critical reality studies).

Keywords: Sociomateriality, socio-technical, agency, critical realism, micro-macro, subjective-objective, data-theory method, ontology, epistemology, analysis, subtle realism, conventionalism, performativity, symmetry, epistemological obstacles.

1   Introduction

"Man is equally incapable of seeing the nothingness from which he emerges and the infinity in which he is engulfed."

- Blaise Pascal (1623-1662)

The information systems (IS) discipline, according to Alter (2013), is challenged by its fundamental term *system* meaning just about anything involving electronic processing, and that a focus on the material, the IT artefact or tool alone, misses the "*broader systems in which IT is applied*" (p. 73). This contrast other management, organisation and information systems (IS) scholars that raise a concern about IS research failing to be specific about technology (Leonardi and Barley, 2008; Monteiro and Hanseth, 1996; Orlikowski and Iacono, 2001).

This is illustrative of a historic dichotomy in the field can be attributed to the difficulty of addressing the nature of the relationship between humans (the social) and technology (the material), and consequently leads researchers to tilt towards either favouring the social or the material in explaining change, practice and performance. In the field of IS the tilting is particularly unfortunate for two reasons (Leonardi and Barley, 2008): *"First, tilting to either social or material explanations of change too often becomes value-laden. Those who emphasize the material antecedents of technological or organizational change are often accused of being determinists and, hence, blind to the role that people play in bringing about technologies' effects on organizing. Conversely, those who privilege social antecedents are chided for ignoring materiality and for being too quick to deny an artifact's demonstrable constraints and affordances. Over time, such stances acquire a kind of moral authority that warrants programs of research that marginalize and even eschew alternative explanations of empirical findings. This leads to the second and ultimately more important problem: theoretical accounts that are epistemologically and ontologically unable to handle the entwining of the material and the social and that cannot speak with precision about degrees of agency and constraint."*

I will in this article address the "*more important problem*", of speaking with precision about the ontological and epistemological aspects of the entwining of the sociomaterial. In section 2 I will show that the discussion is relevant as critique is emerging, arguing that sociomateriality is taking "the wrong turn" (Mutch, 2013). Reflecting on the course, I will, in section 3, introduce an on-going case study from the domain of oil and gas exploration, and show how both the social and material clearly play a role and how the output of the work, the geological interpretations, are influenced both by technology and humans. The question then becomes how to methodologically approach the sociomateriality of such a case? Constantinides and Barret (2012) indicates that this answer is not given: "*...there is still the problem of how to study the constitutive entanglement of the social and the material; where does one start, methodologically and analytically, to trace the entanglement*" (p. 291). I will, in section 4, approach this question in light of two fundamental discussions going on in as diverse fields as qualitative methods, IS, organisational, and sociology and science and technology studies, aiming at avoiding "*the simplifying logics of particular disciplinary approaches or schools*" (Williams and Pollock, 2012: 10). The first discussion is questioning the subject – object distinction, and rather suggest focus on the "*problematics*" of intersubjectivism, subjectivism and objectivism, with their epistemological, ontological and methodological assumptions. Here I will base my discussion in particular on "*Crafting Qualitative Research: Morgan and Smircich 30 Years On*" (Cunliffe, 2011) Second, I will use Hagen and Gudmundsen´s "*Self-Reference and Reflection: Connecting General Theory and Empirical Research*" (Hagen and Gudmundsen, 2011) to discuss how concepts, such as sociomateriality, if assessed in terms of to what degree they create or solve problems in the empirical analysis, can constitute a basis for generalisation and comparison across cases. For each discussion I show the relevance to the sociomateriality discourse and the impact for the case study. Finally I conclude with an emphasis on open and practical methods.

2   Literature review: The Sociomateriality Continuum and the emerging Critique

The need to explain the relationship between the social and the material is not new. During the 1950 and 60s socio-technical theorist explained how technological change could not occur in isolation, and would impact the organisation and work (Leonardi and Barley, 2008). In the IS field it is argued that research has tilted towards

the social, leaving the information system out of the socio-material discourse. In response to this tilting, a "*wave of research*" (Constantinides and Barrett, 2012: 291) on sociomateriality is rising, calling for new ways to analyse and theorise the relationship between the social and the technological. Authors now are suggesting a continuum of sociomateriality research classifying contributions in terms of how they conceptualise the relationship. Mutch (2013) suggests to separate between "strong" and "week" versions of sociomateriality, and Kautz and Jensen (2013) can be read along the same lines. Others such as Mazmanian et al. (Forthcoming), suggests categorisation, and categorise sociomaterial conceptualisations as "separation", "symmetry" and "shaping". For the discussion here, the separation between "hard" and "soft" sociomateriality serves as illustrations of two extremes in what perhaps can be considered a continuum of sociomaterial research in IS.

Understanding sociomateriality requires consideration of epistemological or ontological grounding

The "hard" version of sociomateriality is building on Barad´s (2007) agential realism, and questions the ontological separation between the social and the material, between humans and technology, and between the subject and the object altogether. Orlikowski writes about constitutive entanglement: "*materiality is integral to organizing, positing that the social and the material are constitutively entangled in everyday life. A position of constitutive entanglement does not privilege either humans or technology (in one-way interactions), nor does it link them through a form of mutual reciprocation (in two-way interactions). Instead, the social and the material are considered to be inextricably related — there is no social that is not also material, and no material that is not also social*" (Orlikowski, 2007: 1473). Through reviewing a selection of studies that has taken this ontological stance seriously, Mutch (2013), from a critical realism stance, formulates a critique towards the agential realism foundation of Orlikowski´s argument. The argument is that while the concept of entanglement of atomic composition is applicable in quantum physics (where can we draw a line between the atoms of a cup´s handle and the atoms of the hand holding it?), it is not easily applicable at the level of organization and IT, as not studying the two as separate phenomena, leads to "*confusing levels of analysis; what is useful and appropriate at the level of micro physics is inappropriate at the level of the social. Here the arrangement and behaviour of atoms are beside the point; it is the inter-relations between specific configurations of the material and the social, and the perceptions that these give rise to and shape them, that are the object of analysis. This assertion is based on the stratified nature of reality*" (Mutch, 2013: 35). It can be argued here, as Leonardi (2013) does, that Barad´s point is more towards establishing a notion of reality as so complex, that our attempts at representing reality, e.g. in measuring physics, need to be both intersubjective and constructed. I will in this article argue that this debate is not limited to critical reality versus agential realism, but also targets the more fundamental distinctions between grounding your research logic and scientific concepts (such as sociomateriality) ontological or epistemological (Hagen and Gudmundsen, 2011). It is an exercise with practical consequences for "*questions scholars ask, the phenomena on which they focus their attention, and, ultimately, the insights and ideas they can generate to improve the way that organizations operate*" (Leonardi, 2013). I will return to this argument in the discussion section, but first we need to explore the other end of the sociomateriality continuum.

Understanding sociomateriality requires consideration of the subjective – objective divide

Keutz and Jensen contrast Orlikowski´s "hard" sociomateriality with a "soft" version, where they see Leonardi as one of the main proponents (Kautz and Jensen, 2013). Leonardi applies the concept "imbrication" to indicate more loosely coupled relationship of two separate entities; "*... the term imbrication to capture the simultaneous interdependence and specificity of each the digital and the nondigital. They work on each other but they do not produce hybridicity. (Leonardi, 2011). This position seems to orient towards the tradition that Orlikowski also build on "The challenge for organizational scholars is to figure out how to take seriously the recursive intertwining of humans and technology in practice. A number of particularly interesting ideas for doing so have been emerging in sociology, and science and technology studies over the past decade: for example, actor–networks (Callon, 1986; Latour 1992; Latour, 2005), sociotechnical ensemble (Bijker 1995), mangle of practice (Pickering 1995), object-centered sociality (Knorr Cetina 1997), relational materiality (Law, 2004) and material sociology (Beunza et al. 2006). These concepts challenge and transcend conventional distinctions between the social and the material*" [1] (Orlikowski, 2007). Where Orlikowski suggests a more radical shift in conceptual framing, Leonardi seems to stay closer to the roots in terms of acknowledging a dualism. Growing out of Actor Network Theory (ANT, see Latour, 2005) they all question the separation between the social and the material (or

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[1] References in quotes are not included in the list of references unless used also outside quotes.

the subject-object distinction), taking a more constructivist approach, trying to acknowledge the influence of structure and matter, but without perhaps, ontologically attributing them as one and the same thing. The softer, ANT based approach has also come under critique. Williams and Pollock (2012) address limitations of current "*single site implementation*" studies because they apply a perspective where information technology is viewed as organization level implementations informed by micro sociological analysis and ethnographic methods, that produce partial understandings. Current enterprise systems are more complex and "*far removed from the relatively simple computer applications found in former generations of information systems*" (Williams and Pollock, 2012: 1). ANT has been "*...effective in building "actor-centered" forms of analysis and foregrounding the range of players directly involved in implementation, this approach has been less successful in developing the more complex mappings and understandings that meet the above call that these solutions need to be studied over time and across space."*, and they suggest "*...we need a more "contexted view" (Morrison 2002) able to address the complex social fabric and its history that patterns the activities of those involved locally*" and "*our explanatory frame needs to be one that avoids the simplifying logics of particular disciplinary approaches or schools, and that can match the intricacy of the settings and processes we are studying*" (Williams and Pollock, 2012: 10). Critical reality has also been suggested as a means to this end: "*As an alternative intellectual structure for theorizing digital infrastructure, we propose critical realism (Archer et al. 1998, Bhaskar 1997, Sayer 1992) for its emphasis on generative mechanisms (Bhaskar 1997, 1998)*" (Henfridsson and Bygstad, 2013: 899). This entails going from micro level (local/single site) studies, towards studies that address more of the macro level. Tjora and Scambler, studying information systems in hospitals, make a similar point; there is a "*need for enhanced consideration of meso- and macro-level analyses, for example of professional and policy aspects of the contexts of information systems*" (Tjora and Scambler, 2009: 519). How to do this in practice require us to ontologically, epistemologically and methodologically cut across the subjective-objective divide, or social-material divide if you will, and this will be addressed in the discussion section, drawing in particular on Cunliffe (2011).

Before addressing discussing the implications from the epistemology/ontology and subjective/objective discussion outlined here, I will introduce an on-going case study that illustrates the necessity of addressing the relationship between the social and the material and how to study and theorize about the relationship.

3   Why 21st Century Oil and Gas Exploration is Sociomaterial

"*The basic law of stratigraphy is the Law of Supposition*" – from Geological Howlers, edited by W.D.I Rolfe (1980), quoted in (Ager, 1993)

In current oil and gas exploration, the easy finds have been done, but high enough demand and price drive oil and gas companies to explore areas that are difficult to reach, such as several kilometres below the seabed in the North sea. New discoveries are made utilizing new exploration methods (human interpretations) and new technology (material). Interestingly, drilling an exploration well is still the only certain way to confirm the presence of oil and gas. Drilling is kept to a minimum however, as the cost of running rigs can be up to 500.000 USD per day (one exploration well cost from 10 million USD and upwards Consequently, drilling, the endpoint of an exploration process, is a "luxury", that will only be conducted when the probability is *high enough* that there is a presence of technically and economically recoverable oil and gas reserves.

I am currently conducting a case study in Northoil´s (a large international oil and gas company) exploration unit. Exploration essentially includes generation of a prospect and drilling of an exploration well, to find hydrocarbons, the volume, the viscosity, and how to best produce the hydrocarbon reserves. The very fact that practitioners can not physically go out and verify their interpretations makes the case a *critical* one (Flyvbjerg, 2006), as it has potentially "*strategic importance in relation to the general problem*" (p. 229). The general problem here being how the relationship between people (social and subject) and technology (material and object) play out in practice, and from an IS perspective, be able to design and build information systems that performs better. A critical case can serve to gather data and concepts that allow logical deduction of the type "*If this is (not) valid for this case, then it applies to all (no) cases*" (Flyvbjerg, 2006 p. 230). Other domains that have similar situations are plenty. One example is healthcare, where doctors use technology a wide array of technology to study the human body, without always being able to physically access the phenomena they are trying to interpret. As this logic goes, if constructing concepts that are valid for this case, where verification of interpretations is next to impossible, it would also be relevant for other cases, where verification is less difficult.

The case is a relevant setting in which to study the relationship between the social and the material or the subjective-objective divide if you will, since the only way the geologists and geophysicists (G&G) of Northoil can build knowledge of physically near inaccessible phenomena (except you drill, which is relatively rear; one informant had worked for seven years in Northoil, and have experienced only one prospect being drilled for exploration) is through means of their information systems. Several kinds of interpretations (they are very explicitly stating that it is interpretations they produce, not facts) are iteratively produced through a complex process involving three relevant dimensions; people with different skillsets, information technology of different kinds, and particular interpretation methods. The dimensions are introduced below.

First, in terms of diversity of people, there are thousands of G&G in Northoil. This is not a homogeneous group, there are over 50 different kinds geo-sub-professions, such as geologist, geophysicists, and geochemists represented. Some expertise is located in dedicated expert centres, such as geochemistry, while the more general "explorationists" are organized in interdisciplinary teams. Because of the amount and complexity of data and tools, G&Gs are supported by project data managers (PDMs, co-located in the G&G units, helping the project data administration) and central data managers (CDMs), who are responsible for maintaining the company datastores and keeping data synchronized across datastores. G&Gs and PDMs are organized according to what geographical areas they are exploring. The unit I am studying is Norway, the North Sea, which is an area where Northoil is presently active in licenses as well as exploring new areas. The team is located in an office building and sits in landscapes, where two to five people share offices. They have PCs (windows workstations), typically with several screens, to be able to efficiently work with subsurface models and geographic information systems (GIS-systems).

Second, in terms of data, there is a lot of it available, 110 TB (2011 numbers) and continually growing. There are two main data sources, Diskos DB and the corporate data store. The Diskos DB is a national database where companies operating on the Norwegian continental shelf are required by law to store all of their seismic, well and production data. Searching for this data (such as production licenses, exploration wellbores, discoveries, fields, development wellbores and business areas) is available through a Public Data Portal. The corporate data store holds NorthOil´s proprietary interpreted data, such as seismic interpretations, well data, production logs, and maps, business information such as license areas, infrastructure and business associates are also included. In terms of ICT tools, there are many of them as well, e.g. generalist interpretation tools (Petrel and Openworks), and dedicated specialist tools. The PDMs play a key role in supporting the G&G in retrieving, organizing, maintaining and storing data across tools and datastores.

Third, in terms of the process of exploration, it has the three main steps. First there is a global basin screening and ranking to determine what basins to work with. Following this, basin and prospect evaluation is done. Here the goal is to identify prospects for drilling. The prospects are quality controlled, approved and ranked. Exploration drilling is done and the discovery is evaluated. Finally, the feasibility of the prospect is appraised. In all of these phases different kinds of interpretations are constructed. Typically the G&G would want an overview of all relevant data in an exploration area defined as quadrants and blocks. Quadrants are 1 degree by 1 degree, and blocks of 15 minutes of latitude by 20 minutes of longitude (12 blocks in a quadrant). A request for well data could be formulated as "*within quad 35, find me all wells which have total depth of more than 3000 meters*". The PDMs would find the data (which in itself is a non-trivial task as relevant information can be scattered across data stores as well as working project and team-sites). The G&G will then make a choice of relevant data, and the PDMs populate the project with data. From this base, the G&G start working using their interpretation tools, methods and knowledge for creating interpretations of the subsurface. The interpretation tools contain different kinds of algorithms that support G&G in creating interpretations, representations and simulations. These interpretations will in turn be stored, and form part of the historical archive, ready for future use. An example geological interpretation is to do time-depth conversion. Since seismic data are recorded in seconds (time domain), and well log is recorded in meters or feet (depth domain). This makes the vertical scales on each different and incomparable. But this is necessary in order to correlate seismic with well data (from drilling). The seismic velocity through each layer is known (or estimated), the G&G will do a *time-depth conversion* on the seismic data to make it compatible with well-log data.

The method that the G&G follow in this process is not linear. They do not get all the data up front, do their interpretation, and store it. Rather it is highly iterative, going back and forth between the data and the interpretation they are creating. It is not dealing in terms of facts and accuracy either. The G&G consider their creations and the geological concepts they make as interpretations. And this is also the way they treat the interpretation of others. As an example, when Northoil make an interpretation official in the corporate data store,

they keep a record of who (which G&G interpreter) that made the official interpretation, so that the G&G know what to read into it.

Frodeman (1995) explains the way geologists work as a combination of hermeneutic (interpretative) and historic. Hermeneutics, based on the hermeneutic philosophers such as Heidegger, argue that human understanding is interpretative. It rejects the notion of completely objective data or information, and what we perceive (or interpret if you will) is shaped, though not determined, by how we conceive and act on the object with the tools, concepts and values we have: *The geologist assigns different values to various aspects of the outcrop, judging which characteristics or patterns in the rock are significant and which are not. Examining an outcrop is not simply a matter of ''taking a good look.'' Rather, the geologist picks up on the clues of past events and processes in a way analogous to how the physician interprets the signs of illness or the detective builds a circumstantial case against a defendant*" (Frodeman, 1995 p 963). The geological method is also historical, in that it limits the role of laboratory like experiments and rather depends on two other kinds of reasoning, the problem of natural kinds and geology as a narrative science. The goal is not to come up to identify general laws (as in experiments) for hypothesis testing, but rather to chronicle events at a given location (in a block, in a quadrant, in the north sea, or the planet: "*The crucial point here is that the historical sciences are distinguished by a different set of criteria for what counts as an explanation. To borrow and adapt an example from Hull (1976), when we ask why someone has died, we are not satisfied with the appeal to the law of nature that all organisms die, true as that is; we are asking for an account of the particular circumstances surrounding that person's demise.*" (Frodeman, 1995 p 965).

From these accounts we see that the case at hand can serve two purposes. First, it is a case where the social and material is forming a relationship that merits explanation. As Leonardi notes; "*To bring this example into the realm of technology and organizing, a weather scientist may normally use a computational modeling tool to estimate wind velocity, but the use of a computational tool does not make a weather scientist (it would be possible, though cumbersome, to do such estimation by hand), nor does a whether scientist make a computational tool (the tool could be used to compute many other things, such as energy dissipation in structures). The problem with treating all relationships as mutually constitutive is that the analyst overlooks how and why phenomena get put into relationship with each other, and, consequently, how their relationship might change phenomena other than themselves*" (Leonardi, 2013). Likewise, in the case at hand, the tools and data does not make a geologist, and the geologist does not make a tool, rather it is a question about their relationship. How it changes and is changed by phenomena is then interesting questions, and we must consider the issue of how to answer them. In the next section I will explain how such a consideration necessitates methodological pluralism and a need to question the subject-object divide (section 4.1). Second, as we have seen, the method the practitioners use in oil and gas exploration, i.e. the historical and the hermeneutical, resembles qualitative research methods. Consequently, a discussion concerning the relationship between data and theory and weather we ground our concepts ontologically or epistemologically, should be relevant, and is presented in section 4.2 below.

4 Discussion on the Need for Pluralism

"*First the charioteer of the human soul drives a pair, and secondly one of the horses is noble and of noble breed, but the other quite the opposite in breed and character. Therefore in our case the driving is necessarily difficult and troublesome.*" – Plato (Phaedrus, section 246b)

Thus far we have seen how the discourse on sociomateriality centres around two key issues. First, "hard" sociomateriality that postulates that the social and material should ontologically be treated as one has come under a critique for potentially confusing levels of analysis. Second, "soft" materiality, from its ANT base, has come under critique for over emphasising the local and the single material artefact, loosing sight of more macro level phenomena that shape local/micro level phenomena. We have also introduced a case where at the one hand particular outcomes of work are produced that would have been impossible without both human and technological agency, and at the same time, it it is challenging to treat them as ontologically one and the same thing as they have very distinct properties. The way the geologist work is also interesting as it bears resemblance to the way we approach qualitative research, applying both hermeneutic and historical strategies to understanding and knowing. We have seen how critical reality has been proposed as a way to address the challenges of both soft and hard sociomateriality. In the following I will argue that the debate is not restricted to a debate over agential versus critical realism but rather strikes to the core of on-going debates within qualitative

methods and science studies that has generic methodological implications. I will here discuss it along two main dimensions. First, questioning the subject - object divide, drawing primarily on Cunliffe (2011). Second, I discuss how empirical and theoretical analysis assumes each other "*as mutually constitutive elements*", drawing primarily on Hagen and Gudmundsen (2011). For each discussion I will draw practical implications of the discussions towards the case study at hand as well as discuss their relevance to the IS discourse on sociomateriality.

4.1   Questioning the Subject - Object divide

In 1980 Morgan and Smircich published a seminal article arguing that placing method as the driving force in empirical work, you would risk to ignore the wider context of knowledge, that in turn reduce social research to a technique. They proposed a framework for understanding the debates about rival methods at the time, "*situating qualitative methods within broader philosophical assumptions about the nature of reality and knowledge*" (Cunliffe, 2011 p. 647). Cunliffe sees developments in metatheoretical perspectives, organization theory, research methods and ways of theorizing necessitate revising the subject-object distinction that Morgan and Smircich based their typology on. And why should we care about this? Because "*…our metatheoretical assumptions have very practical consequences for the way we do research in terms of our topic, focus of study, what we see as "data", how we collect and analyse the data, how we theorize and how we write up our research accounts*" (Cunliffe, 2011 p. 651).

Morgan and Smircich argued that researchers must clarify their assumptions about the nature of social reality and what it means to be human, that is, ontology, as well as the nature and purpose of knowledge, that is, epistemology. From this backdrop, the researcher can choose which research methods that are appropriate. Their typology, based on the subjectivist-objectivist continuum, explains different kinds of knowledge and theory building. On the extremes, a subjectivist view reality as individually imagined and a product of the human mind. Humans are autonomous and knowledge personal and experiential. The consequence for research methods is a focus on the individual and its understanding of the world. On the other extreme, objectivist postulate that reality is concrete, external to the individual (even determining their behaviours - determinism), and knowledge is also real by being observable, measurable, regular, descriptive by laws and patterns. In IS, early contingency theorists took an objectivist stance and advocated a deterministic relationship between technologies and organisational structures (Leonardi, 2013). This view has been challenged in IS the same way as the distinction between the subjective and objective has been challenged in in anthropology, sociology and organisation and management studies (Cunliffe, 2011 p.651).

But this distinction no longer holds argues Cunliffe, and the debates along the continuum emerge as researchers embrace post structural, ethnomethodological and hermeneutic ways of theorizing, as well as deconstructive, narrative, and reflexive research methodologies. Cunliffe suggests four (non exhaustive list) reasons why the subject-object antonym no longer holds. First, subject and object are mutually implicated. Structuration theory for example, argues that while the subject and object are separate entities they each produces enabling and constraining conditions that influence each other in practice. Institutional theorists explain organisations as the more stable object, shaping the individual subject. Enactment theorists on the other hand see interactions between subjects as producing objectivised structures. Cunliffe positions early works of Orlikowski as structuration theorist (Cunliffe, 2011 p. 652), that privilege neither but rather attempt to reconcile the two through an iterative process. Orlikowski and Robey say we should use structuration theory to; "*progress beyond several of the false dichotomies (subjective vs objective, socially constructed vs material, macro vs micro, and qualitative vs quantitative) that persist in investigations of the interaction between organizations and information technology*" (Orlikowski and Robey, 1991). Second, some argue a move from subjects to subjectivities. In what Cunliffe refers to as antihumanist view, subject are no longer seen as reflecting human beings, but rather subjectivities that is the result of discourses of power and control that are inscribed in our bodies and actions. Third, both subjects and objects have agency. This originates in actor network theory (Latour, 2005) and postulates a symmetry between the subjects and objects, and that the performance of an organisation cannot be explained focusing exclusively on subjective or objective terms. This stance would correlate to the "soft" sociomateriality we have described above. Fourth, the subject becomes the object, through objectifying humans as generalised identities, and interpreting embodied subjects become interpreted categorized objects (Cunliffe, 2011 p.652).

From this understanding that the subject-object distinction no longer holds, Cunliffe formulates instead three "*knowledge problematics*", intersubjectivism, subjectivism and objectivism, explain the ontological and epistemological characteristics of each problematic, and the methodological implications (Cunliffe, 2011 p. 653). It is important to note that Cunliffe sees the problematics not as silos but rather as clouds, to emphasise their shifting and fluid nature, and that ideas and approaches will, and indeed should, move across boundaries.

First, objectivism has been interpreted more nuanced since the 1980s and naive realism is close to the objectivist end of Morgan Smircich´s continuum. In this view, reality exists independently, and researchers should study the relationship between structures, events and mechanisms or between network elements. Phenomena can be studied out of context, and knowledge can be generalised and last over time. Emphasis is on accuracy, explanation and prediction. They take a macro perspective, study organisations at a structural and strategic level. This strand, based on a positivist epistemology, use surveys, structured interviews, focus groups and observation to discover facts, and data is categorised and coded to form basis for generalisation and prediction. More processual, critical and fragmented objectivist ontologies now emerge, that accept that there is a concrete reality, but that has very different characteristics, as emergent (process approaches), contested (critical/discursive), or linguistically (discursive/symbolic). Cunliffe positions ANT as a process theory that is anti-essentialist in that objects and networks are fluid and only have meaning in relation to each other (Cunliffe, 2011 p. 656). Methods such as ethnography, observation, interviews and grounded theory is used, and ANT studies use boundary object analysis, says Cunliffe, to study how artifacts (micro perspective) and objects create a network or macro actor (Cunliffe, 2011 p. 660). Critical realists would work from a Marxist perspective, and use a retroductive research strategy based on abstract analytical constructions, and empirically observable behaviour, using texts, secondary data, interviews and case studies to identify mechanisms influencing the development of socioeconomic and political (macro level) phenomena. Critical and ANT based studies, again according to Cunliffe, use post positivistic epistemologies, claiming that reality is known only probabilistically, and that verification if not possible. Poststructuralist research work from an assumption of fragmented and constructed realities and subjectivities, where subjectivities are treated as objects situated in macro discourses. Researchers can focus on the humans, but isolate them from experience, and treat them as phenomena to be studied. Researchers analyse discourse (talk and text) at the micro level, and Discourse (language systems) at the macro, analysing texts, as well as semiotic analysis of artifacts signs and symbols.

Second, over the last 40 years, subjectivism has also emerged with more substantive interpretations. Knowledge and meaning is situated and contextualised, and so are our research accounts. The latter is also partial because we do not see all the stories being played out in the organisation that we are studying. There is an ontological difference in the problematic. Towards the right (towards objectivism) discourse based researcher and symbolic interactionists see reality as constructed, but objectified in having a degree of stability. More radical subjectivist accounts are associated with interpretative approaches to social constructionism, where multiple realities are experienced in many ways. Subjectivist researchers use ethnographic, ethnomethodological, dialogic, hermeneutic, constructivist, and phenomenological approaches. And can focus both on micro-interactions as well as macro-level discourses. Cunliffe separates between symbolically and socially constructed reality studies. If you see reality as symbolically constructed you study how people interpret and manage roles, expectations and impressions in their social interactions, buy means of study natural occurring practice, talk in meeting using observations, audio and audio-visual recordings and interviews. Socially constructed inclined research is more interested in participants' multiple interpretations and reflections, and the relationality lies in people rather in language.

Third, the intersubjectivism problematic, see reality as commonly experienced and understood world of shared meanings, interpretations and culture. Our identities and shared understanding of the world are shaped between us in everyday interactions, and experienced differently (relationality). The researcher is an integral part of the meaning forming, and draws on hermeneutic phenomenology, relationally responsive social constructionism and dialogism. Focus is on micro level conversations and research accounts are understandings shaped dialectically between all research participants, particular to a moment, but which may offer interpretative insights for others.

4.1.1   Relevance to the sociomateriality discourse

The above descriptions suffice to illustrate how there are cross cutting ontological, epistemological and methodological concerns here. Cunliffe positions ANT and critical reality into the objectivism problematic, something that perhaps in itself is problematic. Consider for example the issue of performativity. In

sociomateriality, there seems to be agreement in that understanding, meaning and use of information systems are not something stable and fixed, but rather emerge through practice (Monteiro et al., 2012). The notion of performativity is therefore a "*central idea entailed in*" sociomateriality (Orlikowski and Scott, 2008) As we see from the descriptions above, this orients towards the language used in subjectivism and intersubjectivism. Consequently, concepts also from that domain should be considered in studying sociomateriality, such as e.g. social constructivism arguing that reality and meaning, in our case, performing work using information systems, can be experienced in many ways. This point is also made by Law, from an ANT base, referring to Mol (2002): "*In material-semiotic mode, she argues that each practice generates its own material reality. This means that for atherosclerosis there are four actor networks or realities rather than one. Then she says that how these relate together, if they do so at all, is itself a practical matter. Sometimes, and for a time, they may be coordinated into a single reality, but often this does not happen. So Mol's claim is simple but counterintuitive. In theory the body may be single but in practice it is multiple because there are many body practices and therefore many bodies.*" (Law, 2009). But ANT has received critique for being to local and not being able to create accounts that are generalizable. The conventional view would be that a case cannot be of value by itself, and must follow the hypothetico-deductive model of explanation. Flyvbjerg (2006) quotes Mattei Dogan and Dominique Pelassy (1990) stating that "*One can validly explain a particular case only on the basis of general hypothesis. All the rest is uncontrollable, and so of no use*" (p.121). Acknowledging elements of both subjectivism and intersubjectivism does not necessarily mean giving up on attempts on generalizing though. This is a concern for IS, there is a need to do studies that are relevant to practice in more than one organization. Hos this can be achieved is the topic of the next section.

4.1.2   Relevance to the case study

Flyvbjerg (2006) argues strongly for the value of the case study and indeed the possibility to generalize from a case: "*Concrete context dependent knowledge is… more valuable than the vain search for predictive theories and universals*" (p. 224) and "*One can often generalize on the basis of a single case, and the case study may be central to scientific development via generalisation as supplement or alternative to other methods*" (Flyvbjerg, 2006 p. 228). The crux of this argument is that human learning and knowledge is context dependent, and that experts are so because they operate on the basis of knowledge of several thousand concrete cases in their areas of expertise. Flyvbjerg is here echoing his countryman Niels Bohr that argued that an expert is a person who has made all the mistakes that can be made, in a very narrow field. Research should strive to produce (thousands of) rich and informative case narratives that we can learn from and hopefully become experts, rather then search, some would argue in vain, for universals. Strategic choice of case "*may greatly add to the generalizability of a case study*" (Flyvbjerg, 2006 p. 226). It has therefore been suggested to study sociomaterial performativity in cases where the information system is entangled with practice, and that this dominate the empirical setting (Monteiro et al., 2012). Our case at hand is such a "strategic" case, as the only way the G&G can access reality, is through interpretations created in and brought to them through their information systems. As we have seen, they construct these interpretations using hermeneutic and historical methods. The process, oversimplified in the interest of space, starts with the G&G identifying a geological concept that can be a potential reservoir. They must then identify available data (such as seismic and well data) in the area relevant to the concept. The data they use is often produced by other (competing) companies. The data needs to be accessed, and often re-interpreted to make sense in the current geological working concept. Data needs to be traded with other companies, or new seismic need to be shot. Shifting sets of sociomaterial imbrications form as different professions (geologists, geochemists, geophysicists etc.) in a highly iterative process, across different tools, professions and departments, work to produce prospects that potentially can, if prioritized by management, are drilled. To study and understand this case it can be problematic to study one, or a team of, local geologists. Rather one must glance to the wider context. Williams and Pollok (2012) suggest to build a biographical study across time (e.g. the extended development cycle, and foreshortened multisite studies), space (e.g. focus on array of overlapping arenas to capture the link between different sited and players), actors (e.g. use theoretical and empirical understanding to map diverse arrays of local and broader actors, and follow the artifact, such as an interpretation, through space and time), and finally technological field (note the actors that police the field, study the social fabric of the field, and do a systematic study with the possibility of generalisation). This is inline with Blomberg and Karasti who emphasise the considerable construction that goes into a case study, and argue "*…for a willingness to pursue emerging and unfolding connections, flows, and discontinuities in constructing the sites, objects, and topics of ethnographic inquiry.*" (Blomberg and Karasti, 2013).

4.2 Questioning Epistemological and Ontological Grounding

Hagen and Gudmundsen (2011) point to the same trend as Cunliffe in that there has emerged a great variation in terms of theoretical perspectives and methodological approaches. As we have seen, the diversity can be both a strength and a necessity. But in the interest of forming a field of research, contributions must be part of the same project. To achieve this, different research and researchers must be able to "talk" to each other. The current situation in sociology and social sciences bears the characteristics of a standoff between schools that are predominantly concerned with theory on the one hand, and research that is empirical on the other. The crux of Hagen and Gudmundsen´s argument is that scientific concepts and research logic can be argued in two different ways, either ontological or epistemological and that if concepts are founded ontologically with reference to specific traits of phenomena, then different schools of research seem mutually exclusive, something that restrict scholar reflection. If however, concepts are founded on *how they create or solve problems in the empirical analysis*, we can have foundations to compare. Concepts can then be rated more or less fertile, and the research logic induction, deduction, retroduction and abduction can be assigned to different, but complimentary phases of the research process.

Empirical and theoretical analysis complement each other as mutually constituting elements, and "everyone" acknowledge the bidirectional influence between empiric and the theoretic, where theory rests on empiric accounts and theory is a necessary starting point for empirical research. However, as is similar to work on sociomateriality, contributions are fragmented (Leonardi, 2012), something that blocks joint theoretical development in IS in general and sociomateriality in particular. Hagen and Gudmundsen´s way out of the bind is to reconsider how we argue for and construct scientific concepts.

The dominant view in social sciences (and arguably in IS) is postpositivistic in that we "know" that empirical observations cannot be reduced to sensory data, and that it rather presuppose and is loaded with presumptions about what the field of study consist of (e.g. individuals, actions, institutions, systems). How then to choose our concepts (that in turn leads to data generation and empirical analysis)? An ontological argument would choose concepts referencing to the social´s real/actual nature or being. An epistemological account on the other hand would treat scientific concepts more as applicable instruments for empirical analysis. The scholarly assessment in this view would concern the *applicability of the concepts*, and not talk to the inherent properties of the phenomenon (e.g. sociomateriality). Hagen and Gudmundsen foreground epistemology, but does not dismiss ontology, any observation presuppose concepts (postpositivistic insight), but the question becomes how we treat ontologies (Hagen and Gudmundsen, 2011 p. 461).

To understand how to treat concepts, we need to understand how concepts are argued for in science. A research dilemma, such as the actor (subjective/social) versus structure (objective/material) debate, illustrates it. Theories that put to much weight on the actor, may loose sight of the structures influence, while inverse, theories that focus on predominantly on structure may loose sight of the subjects´ choice and actions. Hagen and Gudmundsen contrast Gidden´s (1984) structuration theory, an attempt to create synthesis, with Luhman (1987) that argues that the fundamental idea that society consist of humans is reductionist, and that we should have a new ontology, that the society consist of communication, not humans. The difference here then becomes clear; in an ontological discussion the question is if the concept relates to the nature of the phenomenon, while in a debate about the applicability of the concepts one tries to create concepts that solve problems that research encounters in the analysis. Where the first isolate the concept analysis from empirical research, the other tries to connect concept analysis and empirical analysis (Hagen and Gudmundsen, 2011 p. 463).

Research at the ontological end of the scale would be concerned with questions inviting ontological justification, like; "What is action?" "What is social order?" and "What determines social change?" Another strand of social science literature is more concerned with observing empirical phenomena and are more practical oriented towards method and the relation between concepts and empirical analysis. Drawing on Blaikie (2010), Hagen and Gudmundsen say this line of research asks three different kinds of questions (Hagen and Gudmundsen, 2011 p. 465); What is the case? Why is the case as it is? How can you change what is? The what question concerns discovering social patterns and is answered though a descriptive analysis, and the why questions is about finding means to create change. This should indeed be relevant to IS and sociomateriality, all the time we want the research to bring about better information systems and in turn better work in organisations. In social sciences one or more research logics are used to connect theory and the empiric in the process. These four are induction, deduction, retroduction and abduction. Induction generalise based on observations and express a common understanding of what empirical science is about. The classic version is based on positivistic

epistemology about bias free and direct observation, and an ontology of a world of things and relations of things. These assumptions were criticised because they claim all observation requires (previously acquired) concepts. In deduction on the other hand, the criteria for theory is that you can deduce testable hypothesis. Deductive research is criticised for not being able to show how theories are formed. Retroduction, mostly attributed to critical realism, is based on an epistemological separation between observable and not-observable phenomena in a world with three domains; the empirical, the actual and the real. The empirical domain is directly observable. The actual is sometimes visible, while the real domain only is accessible for experience through critical reality´s interpretation mechanisms. Usually this involves pointing to social structures, processes and mechanisms that the involved actors themselves do not have concepts for or gave not seen. Finally abduction is similar to induction, but is based on other ontological assumptions. Society is not made of things, but of active and creative people in meaningful relations to each other.

The above research logics lead to research strategies that guide important choices in the research process. Induction generate descriptions, retroduction is concerned with explanations, while deduction can do both, nut starting from a theory. Because the research logics are based on different combinations of ontological and epistemological presumptions, they can not be mixed, and can answer some, but not all of three research questions above. But that is what we want to do of course, we want to understand what sociomateriality is, why it is so, and how to change and improve it. To do this, Hagen and Gudmundsen call for a revision of the ontological and epistemological foundations of the research logics, so that a researcher can be flexible and use more than one. Two positions are promising (Hagen and Gudmundsen, 2011 p. 468). *Conventionalism*, which is an epistemology that considers theoretical perspectives as more or less applicable scholar constructs, without deeper meaning, and we can, as researchers relate pragmatically to them. *Subtle realism* is an ontology that assumes an external reality independent of the scientist, but the scientist does not assume properties of this reality. From this starting point, Hagen and Gudmundsen argue that it is equally problematic to work with general theories separated from empirical analysis as it is to use an epistemology that that says they theory should only be induced from actors own understanding – as they both effectively block for a reflection of the concepts´ impact on the empirical analysis.

To understand why it is so challenging to reflect over how we connect concept development of concepts and empirical analysis- To do this, Hagen and Gudmundsen explores why scientific concepts needs justification at all, and shows how in parallel to a critique of naturalism, different kinds of constructivism is emerging (Hagen and Gudmundsen, 2011 p. 473). These are social constructivism, epistemological constructivism and methodological constructivism. Social constructivism, in which they place Actor Network Theory and science and technology studies, is criticised for itself being constructed, and consequently can not talk in terms truth (Hagen and Gudmundsen, 2011 p. 474). As an alternative, Hagen and Gudmundsen argue that epistemological constructivism has the capacity to relieve us from notion that concept and reality must be the same, and therefore relieving us from the demands of "match" between them, and rather talk of fit (for purpose). Accepting this leads us to the next step, methodological constructivism, and it is here that Hagen and Gudmundsen finds a solution to the theory-data divide. We cannot ask question of the type "What is action" as this will assume and ontological justification, but rather those three that we saw above from Blaikie; 1) What is the case? 2) Why is the case as it is? 3) How can we change it? And then add a fourth; 4) Are the scientific concepts applicable or not for the empirical analysis? The research strategies of induction, deduction and retroduction are suitable to answer questions of what the case is and explain why it is the way it is. In so doing, they "free" the fourth one, abduction, to be used to develop new concepts, the creative aspect of the process. They argue that abduction is the research logic that best clarifies how concepts are related to the empirical analysis. They attribute Peirce as the central reference in abduction, and give a much-used quote: "*The surprising fact, C, is observed; But if A were true, C would be a matter of course. Hence, there is reason to suspect that A is true*" (Pierce, Weiis & Hartshgorne 1958:188-189), quoted by (Hagen and Gudmundsen, 2011). In order to explain C, we need to know what A is, and A in our context is a new scientific concept, that, if it existed, would explain observed facts. But the concept does not exist, so where does it come from? The literature mentions three ways. First, epistemological obstacles, which involves exploring what is lacking in existing concepts. The new is rarely completely new, and it must be related to existing scientific terms. Second, rationale points to basic assumptions, and are concepts that determine the relationship between other concepts. Finally, residual categories are chimes to concepts found (implicitly) in existing literature. In summary, for Hagen and Gudmundsen, concepts are developed this way to overcome problems found in empirical analysis, and the ultimate requirements for these concepts are to solve problems in the empirical analysis.

4.2.1   Relevance to the sociomateriality discussion

This was the case for sociomateriality. Orlikowski and Scott describe three historical categories of approaches to address the relationship between the social and the material (Orlikowski and Scott, 2008 p.455): i) discrete entities (with uni-directional causal effects of technology), ii) mutually dependent ensembles (with bi-directional relationship) before outlining iii) sociomaterial assemblages. But in testing the concept of hard sociomateriality, Mutch finds it challenging, as I read Mutch, ontologically and analytically to treat them as one, in particular, since the "*ontological assumptions*" comes from quantum physics and that quantum physics is in itself unclear (Mutch, 2013). Welcoming Mutch´s perspectives, Leonardi sees critical realism as "*one solution to problems presented by agential realism*" (Leonardi, 2013), while Mutch suggests exhausting sociotechnical, ANT and critical reality concepts. Perhaps we should let go of the ontological debate and rather take a more constructive (methodologically constructive Hagen and Gudmundsen would argue) stance. Kautz and Jensen seem to agree: *On second sight, however, it becomes more obvious that this vocabulary, if consistently explained, provides a solid ground for tackling a complex problem within IS research and practice. It allows us to identify and to better understand IS-related phenomena by investigating them in their inseparability as well as in their local separability, intra-action and agency through agential cuts, both in the context of utilization and the development of IS and IT.* " (Kautz and Jensen, 2013). This is definitely inline with Hagen and Gudmundsen notion, that if it solves problems that we face in our empirical analysis, it is applicable. This view goes counter to the traditional deductive research logic of Popper that claimed all induction to be impossible, because all observation requires concepts (Popper, 2009). The criteria for sound scientific theory, according to Popper, is to be able to deduct hypothesis. Leonardi is perhaps less dogmatic than Popper when stating that the choice between theoretical foundations comes with different trade-offs, and one can not simply refer to one as "wrong", bad or worse than others, but rather different and "*better suited for particular contextual circumstances*" (Leonardi 2013, page 73). It seems we are still asking all four of the above research questions in the stream of sociomateriality; what it is, how it is formed, how to change it, and finally, whether or not it is an applicable concept that helps in the analysis. In so doing, following the advice of Cunliffe, Hagen and Gudmundsen, we are vise to not a-priori restrict our conversation based on ontological assumptions, but rather have an open discourse based on an interplay within problematics and the applicability of the concepts that emerge. Scott and Orlikowski in a response to Mutch´s critique, also call on subtle realism: "We *see no reason why critical realism and agential realism cannot work alongside each other, exploring information systems and organizations phenomena through shared commitments to subtle realism — joining in conversation rather than raising up slingshots*" (Scott and Orlikowski, 2013). As the discourse goes, it can serve as an addition to subtle realism, by a conventionalist approach where we consider sociomateriality as a more or less applicable scholarly constructs, without deeper meaning, so that we can, as researchers relate pragmatically to them. One conventionalist activity then is that of removing epistemological obstacles by discovering what is potentially missing in existing concept, such as e.g. critical realism (Hagen and Gudmundsen, 2011 p. 483).

4.2.2   Relevance to the case study

Returning finally to the empirical case from oil and gas exploration we notice two interesting implications of this discussion. First, that the debate in sociomateriality, qualitative methods and science studies seems to have direct relevance to the way work is performed in oil and gas exploration and that there should be grounds to explore this further empirically. Second, that a study of the sociomateriality of the case is not straightforward and need to "*position itself in the tension that characterise the field of knowledge*" to paraphrase Cunliffe (Cunliffe, 2011 p. 666). Attempting first steps of such a positioning for the oil and gas exploration case, the performative stream of research (Law, 2009) from its ANT base advocating symmetry, seems relevant. Such a position requires to revisit the view that Cunliffe has, that positions ANT in the objectivism category, as it is necessary to acknowledge the fluidity and flexibility that historically has characterise the more subjective problematics (Cunliffe, 2011). In so doing, the case I explore would best be conceptualised towards the softer and perhaps performative stream of this sociomaterial research that acknowledges that both social and material agencies have the capacity to exercise a great deal of flexibility, becoming imbricated at certain points for certain purposes (Leonardi, 2012).

Furthermore, to move from solely addressing the micro level, answering the "what is the case" question, and take steps towards answering the "why it is so" and "how it can be changed", requires us to incorporate the macro level in our analysis. Vassenden, comparing grounded theory with extended case method, and pointing to

some issues in them (risking to miss out of macro context and macro-determinism respectively) suggests that this can be done combine the grounded theory principle of emergence to identify what theories to discuss our data as anomalies to, incorporating the grounded theory principle of theoretical sensitivity in the extended case method (Vassenden, 2008 p. 336). Tjora extend this notion in his Stepwise-Deductive Inductive (SDI) method, critiquing studies that say that they are "influenced" of or "based on" grounded theory without doing the key step of theoretical sampling. Rather we should say that we do inductive method, "*or something similar to SDI*" (Tjora, 2012 p 176). SDI aims to combine an inductive "bottom-up" process that goes from data towards theory, with a deductive "top-down" process, that connect to theory. The method is iterative in that you can and should move between levels. An interesting practical aspect of this model is the focus on detailed coding close to the data in the first step, and the focus on using computer tools in the analysis in order to be able to trace and document the coding. The method reflects both the issue of subjective/objective and theory/empiric issues discussed herein. It urges particular sensitivity to the empirical material, systematic work, intellectual capacity and creativity. All key ingredients in generating and evaluating concepts such as sociomateriality.

5 Concluding remarks

In this paper I have supported a sociomaterial research continuum ranging from "hard" to "soft" sociomateriality depending on how contributions conceptualise the technology-human relationship. In the "hard" version, there can be no understanding of the one without the other, while contributions towards the soft end of the scale accept a conceptual distance between them, although still claiming symmetry. I have shown how the hard version has gotten critique for using unclear language (i.e. conceptual blur) (Kautz and Jensen, 2013) and producing confusing levels of analysis (Mutch, 2013), and that the "soft" version with its ANT base has been critiqued for not connecting macro level influence. I have introduced a case that illustrates the problematics of sociomateriality. The case is critical according to (Flyvbjerg, 2006), in that the human process of creating geological interpretation (that is both hermeneutic and historic) is saturated of data and IT tools that are both necessary for the process to work and produce outputs that without these same tools would be very different. There is in other words symmetry performed. I have taken the call to not reside to simplified and singular scholarly approaches seriously (Williams and Pollock, 2012) and identified relevant discussions in sociology and organisational research. I find that the issues discussed in sociomateriality is not just a debate between critical realism and agential realism, it goes towards the core of the scientific questions of the relationship between the subjective and the objective and the relationship between data and theory. I show how although Cunliffe positions ANT and critical reality approaches in objectivism problematic, sociomateriality should cut across ontological, epistemological and methodological borders to embed the notion of performativity of material-semiotics for instance (Cunliffe, 2011). Acknowledging this does not give up on generalisation either, we just need to be strategic in selecting and reporting our cases. I have also shown how the data versus theory debate suggests that we should not impose a-priori ontological blocks, but rather ask questions of the type that allow us to construct concepts that are applicable in our empirical analysis. I suggest that sociomateriality in addition to commit to subtle realism (Scott and Orlikowski, 2013) should glance to conventionalism, as suggested by Leonardi, that considers critical reality as one promising concept (Leonardi, 2013), by pragmatically consider the applicability of concepts without the potential restricting effect of debates of truth. We are also it seems, in the process of exhausting epistemological obstacles by a necessary consideration of existing concepts (such as agential realism, socio-technical and critical reality). This goes to show that we can not just put the data/theory and subject/object discussions to rest, but rather use insight from these discussion to take us towards accepting a plurality of methods and theory in the search for leaning and insight. Pluralism does not mean confusion however, and I have shown the existence of practical attempts at methodologically addressing these problems, such as Vassenden´s combination of data and theoretical sensitivity (Vassenden, 2008), and more practically oriented the Stepwise-Deductive Inductive (SDI) method (Tjora, 2012).

Understanding of the relationship between technology and the human, sociomateriality, cannot be pursued from one ontological, epistemological or methodological school alone. IS requires, similar to what related disciplines need, to welcome different methods and concepts. Our cases require and deserve this kind of open-mindedness towards knowledge building and insight as contrary to claims for universal truth that potentially blocks the conversation and restrict us from exploring what the case of sociomateriality is, why it is the way it is (across the micro/macro and subjective/objective continuum), how we can change it, and the applicability of the concepts we have constructed to speak about it.

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