

This text was published in Bollig S, Honig M-S, Neumann S, Seele C (ed.). *MultiPluriTrans in Educational Ethnography: Approaching the Multimodality, Plurality and Translocality of Educational Realities*, Bielefeld, Germany: Transcript Verlag/Columbia University Press, pp. 141-162.
<http://www.transcript-verlag.de/978-3-8376-2772-5/multipluritrans-in-educational-ethnography>)

The text is posted here by permission of transcript Verlag for personal use only, not for redistribution.

Matters of Learning and Education

Sociomaterial Approaches in Ethnographic Research

*Tara Fenwick, Sarah Doyle, Maureen Michael, Jennifer Scoles,
University of Stirling, United Kingdom*

ABSTRACT

In this chapter we outline a “sociomaterial” configuration that has been circulating in the broader social sciences with useful potential for understanding dynamics of learning, pedagogy, curriculum, policy, and so forth. This approach seeks to examine critically how the social and material not only are entangled in what some call “assemblages” of the human and nonhuman, but also constitute the practices and knowings that comprise education. The chapter focuses in particular on methodologies for researching professional learning and knowing as sociomaterial practice. We draw examples from three doctoral studies-in-progress of learning in different settings: engineers in project teams developing environmental technologies, artists learning to balance multiple activities of art, market and bureaucracy, and health-care workers learning to implement a new technology in a paediatric diabetes clinic. These examples illustrate the insights as well as the dilemmas in working with sociomaterial approaches to make visible the materialities of learning. One key contribution here is the first hand voices of new researchers experimenting with these approaches. The methods and theories are difficult to apply, and the stories here help to reveal the strategies that student researchers adopted to work through the challenges of sociomaterial approaches.

INTRODUCTION

Materials – things that matter – are often missing from accounts of educational processes such as learning. Materials tend to be ignored as part of the backdrop for human action, dismissed in a preoccupation with consciousness and cog-

dition, or relegated to brute tools subordinated to human intention and design. This treatment still tends to privilege the intentional human subject, which is assumed to be different or separate from the material. In educational research, Sørensen (2009: 2) argues that there is a “blindness toward the question of how educational practice is affected by materials”.

However, in more recent educational studies (Fenwick/Nerland 2014; Hager et al. 2012; Jensen et al. 2012; Sørensen 2009), researchers have pressed for much more recognition of the ways that materiality *actively* configures educational practice and knowing, which have tended to be considered as social phenomena. Why this new focus on materials? Materials – objects, bodies, technologies, and settings – permit some actions, and prevent others. They convey particular knowledges and can become powerful. Everyday things such as doors, seat belts, keys, and car parks are, as Latour (2005) has written, political locations where values and interests are negotiated and ultimately inscribed into the very materiality of the things themselves – thereby rendering these values and interests more or less permanent. In other words, material and social forces are interpenetrated in ways that have important implications for how we might examine their mutual constitution in educational processes and events, through ethnographic research.

In this chapter, we discuss our methodological work with sociomaterial perspectives. For us, the important question is not what theories *say*, but the kind of work they can *do* when we are in “the field” of the research site collecting information, or sitting at home amidst masses of notes, photos, and interview transcripts trying to discern useful patterns. Our particular area of study within educational research is professional learning, and we study this ethnographically in various work sites of professional practice. We present three examples from studies, all conducted by doctoral students, to show how different students theorise this notion of “sociomateriality”, and how they each have operationalised it in their research methods. First we offer a brief introduction to key shared ideas of sociomaterial perspectives. Then each of the three doctoral researchers – Jenny, Maureen, and Sarah – describe their particular study and methodological experiments. One key contribution here is the first hand voices of new researchers experimenting with these approaches. The methods and theories are difficult to apply, and the stories here help to reveal the strategies that these student researchers adopted to work through the challenges of sociomaterial approaches. The chapter closes with reflections about implications and questions for educational research.

SOCIOMATERIAL PERSPECTIVES

Many theoretical approaches could be referred to as “sociomaterial”, as explained further on, but it would be impossible to do justice to their distinctions in this brief chapter. The main intent here is to provide a very brief introduction to certain shared commitments and approaches across these theories.

What all of these perspectives tend to share is, first, a *focus on materials* as dynamic and enmeshed with human activity in everyday practices. This is what Orlikowski (2007) calls “the constitutive entanglement of the social and material”. “Material” refers to all the everyday stuff of our lives that is both organic and inorganic, technological and natural: flesh and blood, forms and checklists, electronic records and databases, furniture and passcodes, snowstorms and dead cell zones, and so forth. “Social” refers to symbols and meanings, desires and fears, and cultural discourses. Both material and social forces are mutually implicated in bringing forth everyday activities. This is an understanding of relationships that pushes beyond assumptions that objects and subjects *inter-act*, as though they are separate entities that develop connections. Instead, sociomaterial accounts examine what the complexity physicist Barad (2003) describes as *intra-actions* of heterogeneous elements of nature, technologies, humanity, and materials of all kinds. These elements and forces penetrate one another – they act together – to bring forth what appear to be the solid, separate, immutable objects of everyday life. Things like waves or particles emerge in particular ways according to what Barad calls the “apparatuses” that we use to observe, work with, and make meaning of everyday materials. As we observe and work with them, we create categories that define subjects and objects. These “cuts” in matter create boundaries that define (subjects and objects, activity and phenomena) but also open new possibilities. This is a rethinking of causality as entanglements with surprising effects, not linear relations between causes and effects.

This is a second shared understanding: that all materials or, more accurately, all sociomaterial objects, are in fact *heterogeneous assemblages*. They are gatherings of *heterogeneous* natural, technical, and cognitive elements. All objects and material settings embed a history of these gatherings in the negotiation of their design and accumulated uses, whether lecture halls, presentation software, testing instruments, essays, pedagogical protocols, etc. In examining particular educational practices, researchers ask how and why particular elements became assembled, why some elements become included and others excluded, and how elements change as they come together, as they *intra-act*.

Third, a sociomaterial perspective tends to views all things – human and non-human, hybrids and parts, knowledge and systems – as *effects* of connections and activity. Things are performed into existence in webs of relations; they are not independent entities with inherent properties and boundaries. This starting point highlights not individual things, but the practices through which

boundaries come into being, the practices which define things and identities, the practices which assign value to some while ignoring others. This view also helps us recognise how materials *act*, together with other types of things and forces, to exclude, invite, and regulate activity. This is not arguing that objects have agency: an essay does not write itself. But its particular production is an agentic assemblage of assignment protocols and literary traditions, books and other content sources (entailing all the materialities of library line-ups, slow internet browsers, fortuitous tweets, etc.), post-it notes and piles of paper and tablet computers, the particular affordances and directives of word processing software – all working in and through human bodies and consciousness. Any educational practice is a collective sociomaterial enactment, not a question solely of one individual's skills or agency.

Fourth, most sociomaterial perspectives – in different ways – accept the fundamental *uncertainty* of everyday life, as well as of the knowledge, tools, environments, and identities that are continually produced in it. Unpredictable novel possibilities and patterns are always *emerging*. This may be a familiar notion, but sociomaterial theories offer specific analytic tools that can examine much more precisely just how these new webs or assemblages are emerging – why they come together to produce and mobilise particular effects, and when they do not. These are processes that complexity theory explains in terms of strong emergence (Osberg 2008), actor-network theorists call translation, and Deleuzian new materialists call becoming (e.g. cf. Braidotti 2013). The focus is on the relations between things: how things influence and alter one another in ways that are continuously opening as well as foreclosing new possibilities.

DIFFERENT INTERESTS, DIFFERENT APPROACHES

A wide range of perspectives adopting a “materiality” orientation are being employed to understand and reconceptualise professional learning (Fenwick/Nerland 2014). Those that tend to appear most frequently in contemporary educational research include actor-network theory and “after-ANT” approaches, practice theory, complexity theory, new geographies, “new materialisms”, and activity theory (Fenwick/Edwards/Sawchuk 2011). ANT emerges from post-structural orientations, and is more a diffuse cloud of sensibilities than a theory given its many internal contestations among key writers such as Latour (2005) and Mol (2002). Many terms in the literature, such as “relational materiality”, “material semiotics”, STS (science and technology studies), and “sociotechnical” studies, share core commitments with ANT. Its lasting influences are a networked view of reality and a radical treatment of human and non-human elements as equal contributors to the “networks” that continually

assemble and reassemble to generate particular activities, objects, and knowledge. In education, ANT and “after-ANT” perspectives have been employed to examine issues of curriculum, teaching and learning, educational policy, and assessment (Fenwick/Edwards 2010).

Complexity theory is much different in orientation, and affords a range of competing approaches emerging not from sociology but chiefly from evolutionary biology and physics, cybernetics and general systems theories. Complexity theorists Davis/Sumara (2006) and Osberg (2008) have become particularly influential in educational studies, suggesting that we examine dynamics of “emergence”, diffraction, and connectivity in practices of knowing. Turning to new human and cultural geographies, these theories examine the material spaces and places of professional practice to show how they help produce the social, but are also produced by human activity and meaning (e.g. Massey 2005). It is also important to mention the growing educational interest in “practice theory” which draws from notions of “knowing-in-practice”. That is, practice is understood to be collective, emergent, material and more-than-human; knowing is embedded in and expressed through practice (Gherardi/Strati 2012; Hager/Lee/Reich 2012; Nicolini 2013). Finally, another branch of studies that is gaining much traction in education is calling itself the “new materialisms” (Coole/Frost 2010). These studies often draw from ideas of philosopher Gilles Deleuze – such as immanence, creativity, and assemblage – to examine how particular social and material forces bring forth very different ways of being. The most immediate implication of these ideas for professional learning and practice is to challenge traditional individualist notions of causality, agency, and change: professional activities, including “errors”, are understood to be part of emergent systems. Materiality, as Coole and Frost (2010) explain, is always more than mere matter – it is an excess force, a relationality that makes matter active in what occurs in everyday professional practice.

Obviously this chapter cannot address the many additional perspectives relevant to a sociomaterial focus. For example, many educational ethnographers draw methods from the Developmental Work Research protocols that have been developed as part of cultural historical activity theory (Daniels et al. 2009 for DWR methods applied to studies of multi-professional learning). Other educational ethnographers have worked with Knorr Cetina’s (1997) notions of “epistemic practice” and “epistemic objects” to examine professional learning (e.g. cf. Jensen et al. 2012). Also omitted here are discussions of all the limitations that could be ascribed to these different sociomaterial theories, as well as the critical debates amongst them (cf. Fenwick et al. 2011). The intention here is to provide a glimpse or a taste – an introduction showing selected sociomaterial theories in action. These begin with the assumption that learning and practice is more-than-human, and that to understand these educational processes we need to move beyond preoccupations with human meanings and human agency.

MAPS, DOUBLES, AND PHOTOS: JENNIFER SCOLES

In my doctoral research, I was interested in understanding how professional knowing changes and adapts in contexts of high uncertainty, innovation, and volatility, which is increasingly the case for many practitioners. Using ethnographic methods, I chose to focus on the professional knowing of engineers in the emerging sector of renewable energy, specifically that of the wind turbine industry. Over a period of six months, I observed, shadowed, and interviewed engineers in Turbo UK (a pseudonym for a renewable energy firm that installs and maintains wind turbines around the UK). In these observations it became clear that engineers' knowing emerges with and becomes defined by the specific technologies, discourses, bodies, and objects of their work; nonetheless their training still emphasises disciplinary knowledge of formulas and models.

The process of knowing is very hard to study. Blackler et al. (1993) recommend that research on knowledge work should centre on what people do in their work practice rather than what they know. The professionals' role, in this case as engineers in a renewable-energy organisation, achieves its form as a consequence of the relations in which it is located in day-to-day work. It is by tracing and following the micro-practices of their routines that we can start to understand engineers' professional knowing. Thus Gherardi's (2011) "knowing-in-practice" provides an approach from which the researcher can situate their understanding of knowing as relational to the practices as they unfold.

In particular, I borrowed approaches from actor-network theory (ANT) to inform my methodology. ANT considers both humans and non-humans capable of bestowing agency and exerting force. It aims to trace and describe the relational practices, or the networks, which underlie a practice in question, for example, how a workplace comes together and consequently stays together. As Latour (1999: 19) argues, ANT is a useful framework to understand work practices, because it aims to relocate the power held by the social scientist to that of the actors as only they "know what they do [...] and how and why they do it". The idea of such an approach calls for the researcher to follow the tiny details of a practice wherever they may lead, and this includes following material as well as human traces. Following objects is not new to ethnography. In fact, it is a crucial factor of traditional ethnography. What is new, and what an ANT approach brings to the fore, are the interactions and relations between and among the humans (employees, customers, and stake holders) and the materials of their environments. What holds, or fails to hold, practices in place are these sociomaterial assemblages: rules, texts, signs, supervisory gazes, processes, office spaces, management documents, meetings and teams. Finally, ANT is a useful sensibility to adopt for a study on emerging sectors, like that of renewable energy, where professionals are working in unpredictable and uncertain environments with highly variable knowledge demands, and "[...] in situations where innova-

tion proliferate, where group boundaries are uncertain, [and] when the range of entities to be taken into account fluctuates" (Latour 2005: 11). The engineers' knowing at work is contingent upon spaces and places, political incentives, turbine technologies, tools, materials, software packages and time constraints, all of which are highly volatile in this sector. Therefore, this perspective situates practices as precarious and messy alignments and stabilisations of human and non-human actors amongst a multiplicity of perspectives.

Tracking the sociomaterial in research

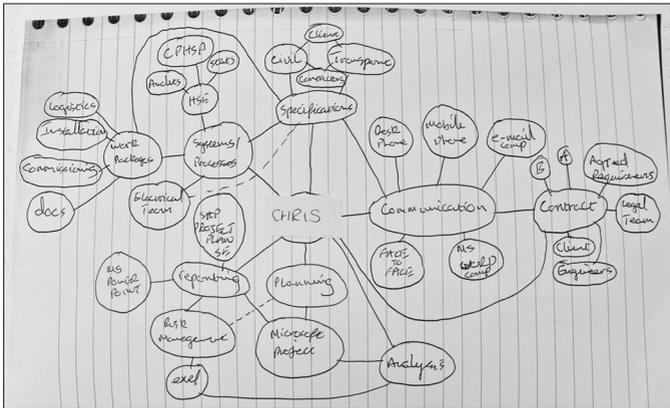
Following these sociomaterial traces presented me with a theoretical and methodological conundrum: objects themselves cannot speak back and explain their intentions. Conducting observations and following these materials can only lead your data collection so far, so researchers tend to resort to reverting our attention to the humans to provide their views on their entanglement with materials and technology. Thus, humans continue to maintain privilege over objects, a position counter to ANT's arguments. However, I found it difficult to maintain this ANT symmetry in a study focusing on professionals' knowing. Given my focus on how this knowledge emerged in volatile environments, I genuinely wanted to know what the intentions of the engineers were, and how they were positioned and positioning themselves in relation to the objects, settings, and technologies through which they worked. This is part of a larger issue that I wrestled with throughout my thesis: my own training as a psychologist kept surfacing and I found it nearly impossible not to keep returning to human experience of materiality as a key informant of the relations. In short, I wanted to hear the voices of the human actors. So, as well as systematically observing and photographing the engineers' everyday activities, I conducted interviews. In these interviews I experimented with methods of mapping, interview to the double, and photo elicitation to get the engineers talking about the sociomaterial relations of their practice. I will briefly discuss the first two methods below, then spend more time explaining my experiences with photo elicitation in this study.

Mapping relations with objects

Over the course of the six months in which I observed participants at work, I interviewed them individually at least three times. In the second interview, I asked participants to draw a mind map, noting all the people and objects with whom they came into contact on an average day to get their work done. These mind maps were to be different from traditional relational maps, as they were to show relations between themselves and objects as well as humans, not just list objects as associated with particular humans. As the participants sketched the

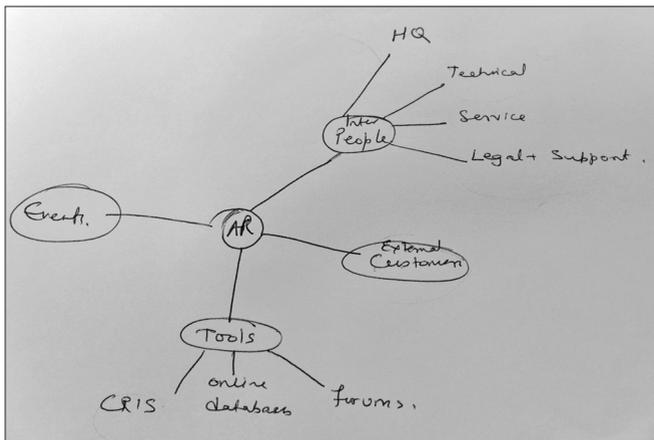
map (they did this while I was there), they often talked about the links between themselves and the objects they used to get their work done. Most observed that they found themselves writing down objects that they had not thought about in our first interview, during which I had simply asked them to describe how materials affected their everyday work. Here is one example (figure 1).

Figure 1: Mapping objects in everyday work – example 1



As you can see, “Chris” (a pseudonym) began to define all sorts of social-human assemblages that compelled his work, and even began to represent certain processes and protocols as material forces. Not everyone found this exercise useful, however, and some found it very difficult to work with this mapping genre to represent the micro-details of their material work (see figure 2).

Figure 2: Mapping objects in everyday work – example 2



Interview to the double

“Interview to the double” is a technique popularised for practice-based studies by Nicolini (2009). Essentially the interviewer asks the participant to narrate precisely what they do to accomplish a particular practice – as if giving detailed instructions to someone who is going to impersonate them without being suspected by colleagues. I tried this in an interview late in my data collection. The instructions I gave were something like this:

Imagine that tomorrow, an alien that looks exactly like you – your double – has offered to come to work to take your place (you get a free day off). In order not to betray the switch and alert your colleagues, the alien must conduct himself exactly as you behave, down to the smallest detail of personal habits. Therefore, please give detailed instructions to me as if I were your double, on precisely what I must do from the moment I enter your workplace. Start with “First you must [...]”.

Overall, this exercise had varying degrees of success. Most participants began with plenty of detail about how they booted up their laptop, got their coffee, and prioritised their workload. However, by the time they got to their afternoon activities, they often said “and then I just went to meetings and did my tasks on my to-do list”. Many seemed to struggle to remain at the micro-level. Sometimes I directed the participant to describe a particular practice, such as attending a site meeting on the wind farm site. This seemed to work much better, with greater detail and more instructions, perhaps because there was concrete focus and boundaries provided by the delimited time frame. Overall, this exercise was most useful for helping participants to recognise and verbalise a range of small tasks that make up their everyday practices, tasks that they often take for granted when simply asked to describe their work practice.

Photo elicitation

Asking participants to show or discuss with me the “things” of their practice is very challenging. Explaining myself to them as being “interested in exploring the relationships between the humans and non-humans of their workplace” often drew blank, and slightly concerned, looks. One way of communicating an understanding of these relationships is to photograph the materials and invite the participants to discuss them in an interview, a method called “photo elicitation”. When taking photos for this type of interview, Harper (2002: 20) encourages the researcher to “break the frame”, avoiding photos of things that participants are used to seeing in their everyday, or altering the angles of photos, towards promoting “a reflective stance vis-à-vis the taken-for-granted aspects of work and community”. I

then asked the participants also to take photos themselves of the “things” in their practice for our final interview.

These practical procedures may seem mundane, but they are in fact very important when we consider how to engage research participants in making more visible the materiality of their work and the emergent sociomaterial systems within which their knowing is entangled. Photo elicitation and object mapping helped participants to realise how “things” affected their activity, whereas their initial conversations tended to focus on their interactions with humans: clients and colleagues. All the participants agreed that, while these methods of interview to the double and photo usage were novel to them, the methods opened new ways of appreciating their practice and their own. People who were used to thinking in terms of plans and decisions began to note the many material influences on what eventually materialises as a plan or a contract. In terms of research process, these methods also helped prompt concrete discussions of professional “knowing” with these engineers, moving beyond abstractions and mentalist orientations of knowing to actually describe specific instances of knowing emerges in their practice – while practice emerges in their knowing.

SEEING SOCIOMATERIALLY WITH VISUAL METHODOLOGIES: MAUREEN MICHAEL

My doctoral study, “Precarious practices: A visual study of the work of artists”, seeks to understand the knowing of artists and how they learn this professional knowing. I sought to reach this understanding through an image-based attention to what artists do and which objects are involved. Two questions are at the core of the study: What are the sociomaterial practices that come together in the work practices of the visual artist? How does professional knowledge emerge through these sociomaterial practices? I understand sociomaterial practice as the material constitution of social life. I draw from Schatzki’s (2001: 3) “materially mediated arrays of doings and sayings” but more specifically from Knorr Cetina’s (1997) object-centred sociality where professional practices gather around unfolding objects of knowledge.

As an artist myself, I decided to employ visual methods in my research using digital photographs as well as drawings, as described by Pink (2011 [2007]). In particular, I tried to use these visual methods not only in data collection but also in analysis. In this approach, the visual medium and the arts-based tools themselves were to become visible as actors in the research process. I began by taking dozens of photos of four artists at work as I observed them in different locations of studio, home, exhibition space, meetings, and travel. Then I drew multiple iterations of selected photos to experiment with interpretations of their content, as well as to play with the whole process of representing lived

experience through ethnographic methods. This methodology itself is materially inclined, which lends it congruence with the sociomaterial leanings of the underpinning practice theory. The materiality of the artists' practices cannot be avoided, in part because the materiality of the visual methodology keeps drawing attention to it. For artists, actions of working are entangled with the materiality of their artwork and their social world. The entanglement of these sociomaterial relations is a phenomenon of fascination, but, as we study it, do we risk disentangling, and thus obscuring, the very relations we hope to illuminate? How can these relations be observed in a way that avoids unravelling and concealing the phenomenon? These issues posed concrete struggles for me as I played with various representations of these relations through visual art. The visual approach itself brought analytic predicaments. Drawing an analysis performs different work than expository text-based analysis. Different languages are employed and different orders of analysis emerge. As a written text demands a particular literacy in order to be read, so an image demands a different, visual, literacy in order to be viewed.

To illustrate this process, I have selected an example from my work with one artist, Roddy Buchanan. I visited Roddy eight times over six months to observe his learning in practice, taking 236 photos of his everyday practices. Looking across the images, I became aware that Roddy is often depicted sitting at his desk in the "admin room" of his studio (figure 3). The images intrigued me because they are so seemingly static and uninteresting as to be invisible. It is a recurring scene throughout the six months of fieldwork and I felt compelled to understand the moment of practice further.

Figure 3: "Roddy 01" photo



Material and visual process of analysis

In my thesis, I described the content of this image in terms of what Roddy is shown to be doing, as well as in all the formal aspects of composition, colour, and perspective. However, in all acts of description there remains what was not described. Just as a written description oscillates between representation and construction of something observed, my drawing of a photograph – even when I trace the lines rather than drawing free hand – oscillates between efforts to mirror what I see and deliberate decisions to interpret and create something new.

Figure 4: “Roddy 01” drawn interpretation



Using a fine black pen, I followed contours and edges, tracing shapes and half-shapes through translucent tracing paper. The drawing “Roddy 01” (figure 4) is the first of many such tracings. Mindful of what is traced and what is left untraced or partially traced, these lines began to analyse the image visually. In creating “Roddy 01”, I appealed again to some formal aspects of composition, shape, and line: I became more aware of the diagonal split from the top left, down to the bottom right, a split that I saw more clearly as my eye followed the line of Roddy’s sleeve to the edge of the mousemat. The central rectangles of the monitor are described only in black line and white space. There are no flashes of colour to guide the eye across the image. Instead, the changing relationships between black lines and whites spaces are all that is used to direct, or misdirect, attention. The cabling is shown fused with the monitor, the key-

board, the mug, the table, and Roddy. When tracing the lines, I chose to create spaces and imply connections; I chose to leave items incompletely traced, but then fixated on the tiny mark-making that might construct the short dark hair of Roddy's head. It is not a resolved drawing. There are too many things being tried out (the deliberate joining of things, the unfinished objects, the over-attention to details of hair, collar and cuff) and this results in an incoherence that is not deliberate. I expected this drawing to be the means to another drawing, another visual analysis of the visual and material phenomenon that is the work practice of the artist. In this form, the analysis does not translate one literacy into another. Rather, as Pink (2011 [2007: 119]) suggests, it explores the relationship *between* the visual and the material.

Rethinking visual analysis

The drawing is both a new aesthetic production and a visual act of analysis. The act of analysis occurs in the selected drawing of lines and the attention to space, texture, colour, and form to explore particular relations of both knowledge and practice. In the creation of "Roddy 01", I drew attention to some things and I averted attention away from others. This is no different to analysing field notes or transcripts: the analysis is always subject to the decision-making process of the analyst. This analysis rehearses ideas of visibility and materiality as a sociomaterial methodology for the study of practice. Much like the drawing of "Roddy 01", these ideas are unresolved, but, in bringing the visual into conversation with the material, I create an innovative methodological space that is enacted through an interplay of material technologies and processes with visual acts of observation and analysis. Even my simple description here of a single photograph and a single drawing performs the unfolding predicaments of a visual approach to the study of practice: from observational fieldwork to managing digital images; from describing images to analytic drawing. There is likely nothing new in this interplay among everyday lived experience, representation, and visual media in the research process. However, for me as a student researcher, the process has been a profound awakening to the sociomaterial ways in which I – my body, mind, hands, and interests – am interpellated with my research participants and with the knowledge that we are producing together. Attending this closely to the visibility of practice as well as the materiality of research, I have come to see how research practices actually constitute the practices and learning that we purport to study.

DIFFRACTIVE METHODOLOGIES: SARAH DOYLE

My doctoral study examined the emergence of professional knowledge in health care for paediatric diabetes. Children with type 1 diabetes need a regular supply of insulin administered either by injections or by an insulin pump (Continuous Subcutaneous Insulin Infusion). Children administer insulin several times each day, with parental support. They also do finger-prick blood tests to measure their blood glucose levels and then record the results. The emphasis in my research was on the work practices and knowledge required on the part of the professionals as they support these children and families. The research took place in a busy Paediatric Diabetes Outpatient Clinic. Data collection comprised observations of work practices including consultations with children and their families, professional meetings and informal interactions; interviews with professionals (transcribed for subsequent analysis); documentary analysis; and examination of artefacts. Here, I show how Barad's (2007) particular arrangement of theoretical ideas highlights the specific effects of different diabetes treatments and implicates particular technologies as active participants in the emergence of professional knowledge.

In paediatric diabetes, professional practice and knowledge are typically understood to be about human relationships. However, as most sociomaterial researchers would appreciate, such health practices are also fundamentally about blood tests, needles, medicines, insulin, injections, hospital clinics, political policies reconfiguring health care services, complex new treatment regimens, and emerging technologies. This recognition does not excise humanness from the investigation, but emphasises that the study of professional knowledge practices does not entail an exclusive focus on the health professional. Spending time in the field, in this case a children's hospital, opened myriad possibilities for alternative focal points.

Thinking social and material together

As mentioned in the introduction to this chapter, Barad's (2007) goal is not simply to recognise that both social and material *matter*, but to examine *how* they matter. Developing her philosophy of *agential realism*, Barad contends that this way of understanding causal relationships reframes traditional notions of cause and effect. The notion of entanglement denotes the entwining of more than just objects and people, to include also mutually constituted agencies (Barad 2007: 33). It is not that separate, delineated entities come together to interact, rather things already loosely connected participate actively with each other to produce particular phenomena. Technologies and professionals *intra-act* towards the production of professional knowledge. Using this approach,

it becomes possible to examine that knowledge by tracing the participation and effects of technologies.

Following Barad (2007), I began to discern professionals and technologies working together in dynamic constellations. Early in the study, one particular comment from a senior professional caught my attention. I was told: “Diabetes is a different illness with an insulin pump”. Insulin pumps are increasingly available and offer an especially precise way of administering frequent, small amounts of insulin. Figure 5 shows a small, battery operated digital pump unit, approximately the size of a small mobile phone. A cartridge holds the insulin, and would normally be inserted inside the plastic pump unit. The length of clear tubing attaches the pump unit to the body, usually into the abdomen via another very fine plastic tube called a cannula. A needle would be used to insert the cannula under the skin of the abdomen and an adhesive patch applied to hold it in place.

Figure 5: Insulin Pump



I began noticing the insulin pumps and the ripples and waves they created. I became curious about the effects they produced, and the ways they participated in professional work practices. I began to watch not how professionals used insulin pumps, as if they were inert tools with fixed boundaries, waiting to be manipulated, but what happened when insulin pumps played a part.

One challenge in assuming a sociomaterially-entangled world is its analysis: how can these tangles be investigated? Barad (2007) emphasises that the theoretical frame is active and creates effects. The methodology itself participates to configure the study. Initially, it seemed as if it would be straightforward to avoid focusing on human thoughts and feelings, and instead to sustain attention to professional work practices. But this it required continual work to achieve, even though it was built into the research design from the beginning.

For example, ethnographic research seeks direct engagement with the social world and in-depth investigation through observations, interviews, documentary analysis, and examination of artefacts (Hammersley/Atkinson 2007). Involvement in the day-to-day lives of the research subjects is key, and there is a firm commitment to “study situations close-up, intimately” (Marcus 2008: 4). At first glance these commitments appear to support the study of everyday professional practices, but the inherent prioritisation of human perceptions and cultural influences seriously limits the capacity to encounter entangled agencies. It has not uncommon in sociomaterial research to adopt strategies akin to Latour’s (2005) injunction to “follow the actors”, who may in fact be object assemblages. I found that purposefully following the insulin pump instead of the professionals using it helped make a different “agential cut”. This perspective helped avoid slipping into a study of, for example, how professionals use tools or how professionals respond to technologies, which would have reintroduced a human-centred preoccupation and undermined the assumption of equivalence I sought to maintain.

Diffraction analysis

According to Barad, the agential cut resolves the indeterminacy of relational entanglements and produces a boundary. Separability emerges even though it continues to be provisional. This concept of the agential cut was especially useful as I grappled with the analysis of the data. I struggled to reconcile the need to make appropriate reductions to the data without losing the essential connectedness that constituted the intra-actions I wanted to examine. Foregrounding the insulin pump and according it agential capacity allowed me to make considered decisions about where to cut the data together and apart. I understood these cuts not as permanent fixes but instead as provisional resolutions. As I came to sense the implications of these ideas, I spent lengthy periods moving back and forth across the data. I was trying to find an analytical method that would respect the mutually constituted nature of entangled agencies and yet still allow me to unravel the intra-actions just enough to examine their workings.

A reconsideration of Barad’s (2007) concept of diffraction helped me to move forward. Understanding the essence of diffraction is aided by considering it through another, more familiar, optical process: reflection. Reflection is a process of reflecting a two-dimensional mirror image, whereas diffraction is a process of patterning the effects produced (Barad 2007). A commonly used physical example of diffraction is the rainbow effect produced when light bounces off the surface of a CD or DVD: the light is diffracted and its component parts become visible. This rainbow effect is fundamentally different from the light reflected by a mirror.

I approached the analysis of my data through the mechanism of diffraction. I looked for ways of patterning the different effects produced by different technologies. My field notes and transcripts contained a wealth of sayings, seeings, and writings about everyday professional knowing in paediatric diabetes, and, as I organised my data according to particular technologies, I began to notice how these particular technologies really *mattered* in the specific knowledge practices they implicated. Using the idea of the insulin pump as a diffractive mechanism, I sought to pattern the different component dimensions of professional knowing that intra-act when insulin pumps participate. Working slowly, I gathered the strands of data that spoke somehow to the insulin pump. I was able to cut together the professional concerns about insulin pumps being unsafe in inexperienced or inattentive hands and the requirements for numeracy and commitment to make them a viable treatment option. I cut together the different work practices of recording blood glucose levels that accompanied insulin pumps and the different software packages that replaced handwritten diaries. I cut together particular photographic images, especially one that captured little rows of new insulin pumps, ready for eager wearers, packaged in boxes sporting an image of a young woman snow boarding.

In this context of paediatric diabetes, insulin pump technology shapes professional knowing in specific ways. The different work practices and demands on professionals that are invoked by the technology produce a knowing that is not the same as knowing the more familiar insulin injection therapies. The professional knowing in everyday clinical work is changed: the technology unsettles existing arrangements and co-produces new entanglements.

I have described some of the early but progressively deepening iterations of working with data generated through sociomaterial investigations. Holding the insulin pump at the centre of my data collection and data analysis does not suggest the insulin pump is at the centre of professional health care practice and knowledge. Instead, this provisional foregrounding of the insulin pump enables my sustained attention to sociomaterial entanglements. In this way, the specific intra-actions that really *matter* in configurations of professional knowing start to become visible.

I have described some of the early but progressively deepening iterations of working with data generated through sociomaterial investigations. Holding the insulin pump at the centre of my data collection and data analysis does not suggest the insulin pump is at the centre of professional health care practice and knowledge. Instead, this provisional foregrounding of the insulin pump enables my sustained attention to sociomaterial entanglements. In this way, the specific intra-actions that really *matter* in configurations of professional knowing start to become visible.

CONCLUSIONS AND IMPLICATIONS

This chapter has provided a glimpse of sociomaterial approaches used in conducting ethnography in educational research. The three doctoral students whose ethnographic work has been featured here have each shown how these approaches offered useful ways to trace the materiality of learning and knowing practices in their own research. These studies are all focused on professional learning in the activities of everyday work, which is an important branch of educational ethnography. In particular, the researchers are each exploring the relations among professionals' changing understandings of their work, identities, bodies, and clients with their changing built environments, instruments, and technologies. This chapter has highlighted a very small piece of each study to illustrate new researchers' experiments with sociomaterial approaches at various points in the ethnographic process: data gathering (Jenny Scoles), data interpretation (Maureen Michael), and analytic theorising of the material (Sarah Doyle).

Jenny's study of engineers' knowing practices in a new and continuously innovative industry offers some methods to elicit information about actors' entanglements with their work materials from the research participants themselves. In particular, Jenny experimented with methods of visual mapping, photo elicitation, and "interview to the double" popularised by Nicolini (2009). Maureen's ethnographic study of artists' everyday work and learning uses visual arts methods in the actual interpretation of her data. Her juxtapositions of progressive drawings from digital photographs showed nuances of how materiality is interwoven with artists' changing knowledge and creative processes. Sarah studied professional learning related to the introduction of new technology in health care. After her initial analysis of the data, Sarah used broader heuristics of "intra-action" and "diffraction" to analyse the different sociomaterial worlds that she began to recognise, as practices incorporating the new technology jostled alongside entrenched practices using conventional technologies. All three studies began by interrupting the notion of "human actors" as self-evident, and unsettling any categories that they found themselves adopting. They attempted to focus on what seemed banished from view: what was ignored as if unimportant, and what was made "other" through the foci of their study. Finally, each researcher set about to unpick assemblages, highlighting the role played by different participants whether human or non-human. In each case, these student researchers also had to theorise their own material participation in the unfolding phenomena that they were studying: both in terms of their presence and relationships in the work settings that they observed, and in the knowledge that they produced with their chosen research apparatuses – enmeshed of course in the events that they observed. The value of hearing student voices describe this process is in appreciating just how difficult it is to learn it and to

articulate it, as they have tried to do in this chapter. Each found an entry point and a strategy to “hang onto”.

These three studies illustrate not only different methodological approaches but also different theoretical traditions that can be described as “sociomaterial”. Jenny works with actor-network theory, particularly drawing on Latour (2005) and Orlikowski (2007) to trace the ways that humans and technologies produce one another, and to examine the performances and boundaries that are produced through sociomaterial assemblages. Maureen’s study draws from visual sociology and aesthetics (e.g. Pink 2011 [2007]), but it is located in sociomaterial conceptions from Schatzki’s (2001) focus on practice “bundles” and Knorr Cetina’s (1997) notion of epistemic objects. Sarah’s theoretical bases are entirely different again: she is informed chiefly by the complexity theory and new materialism of Barad (2007). In each case, these researchers have found that sociomaterial understandings of the everyday worlds they are studying offer an important counterpoint to the human-centric traditions of studying professional learning, which tend to emphasise cognitive, emotional, and social dimensions. Although these dimensions are important, they are inherently wrapped up with materialities in particular ways and with particular effects that ethnographic work can help to make visible.

Of course, these and other sociomaterial methodologies and conceptions are only valuable in terms of the work that they do to help us examine the educational issues that call for research. In the end, the important thing is not the techniques we use but the questions we ask. For student researchers in educational ethnography, sociomaterial perspectives suggest questions like those below, questions which are manageable and practical in the worlds of professional education and learning:

- How are the range of actors – material and virtual, human and non-human – influencing what is enacted in education?
- What kinds of learning are promoted through particular sociomaterial assemblages? What kinds of pedagogies?
- How do some educational practices become stabilised and durable (and not others)?
- When do sociomaterial “black boxes” create problems, and how? (e.g. inclusions and exclusions, etc.)
- What material elements *limit possibilities* for education and learning? When/why do these resist efforts to change them, and why? When do they escape notice?
- How do sociomaterial assemblages produce particular identities, boundaries, centres of power?

In conclusion, sociomaterial approaches offer resources to consider systematically both the patterns and the unpredictability that makes educational activity possible. They promote methods to recognise and trace the multifarious struggles, negotiations, and accommodations whose effects constitute the “things” in education: students, teachers, learning activities and spaces, knowledge representations – such as texts, pedagogy, curriculum content – and so forth. Rather than take such concepts as foundational categories, or objects with properties, they become explored as themselves effects of heterogeneous relations. Finally, sociomaterial perspectives offer important approaches for understanding the power relations and politics that constitute learning: analytic tools not just for picking apart the ways powerful webs become assembled as knowledge, but also pointing to affirmative ways to intervene, disturb or amplify these webs.

ACKNOWLEDGMENTS

This chapter draws from Fenwick’s keynote presentation to the conference “MultiPluriTrans: Emerging Fields in Educational Ethnography”, November 21-23, 2013, Luxembourg. It also draws from ideas developed in previous publications such as Fenwick (2014) and Fenwick et al. (2011).

REFERENCES

- Barad, Karen (2003): “Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter.” In: *Signs* 28/3, pp. 801-831.
- Barad, Karen (2007): *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Durham: Duke University Press.
- Blackler, Frank/Reed, Michael/Whitaker, Alan (1993): “Editorial Introduction: Knowledge Workers and Contemporary Organization.” In: *Journal of Management Studies* 30/6, pp. 851-862.
- Braidotti, Rosi (2013): *The Posthuman*, Malden: Polity Press.
- Coole, Diana/Frost, Samantha (2010): *New Materialisms: Ontology, Agency, and Politics*, Durham: Duke University Press.
- Daniels, Harry/Edwards, Anne/Engeström, Yrjö/Gallagher, Tony/Ludvigsen, Sten Runar (eds.) (2009): *Activity Theory in Practice: Promoting Learning across Boundaries and Agencies*, London: Routledge.
- Davis, Brent/Sumara, Dennis J. (2006): *Complexity and Education: Inquiries Into Learning, Teaching and Research*, Mahwah: Erlbaum.
- Fenwick, Tara (2014): “Sociomateriality in Medical Practice and Learning: Attuning to What Matters.” In: *Medical Education* 48/1, pp. 44-52.

- Fenwick, Tara/Edwards, Richard (2010): *Actor-Network Theory in Educational Research*, London: Routledge.
- Fenwick, Tara/Edwards, Richard/Sawchuk, Peter (2011): *Emerging Approaches to Educational Research: Tracing the Sociomaterial*, London: Routledge.
- Fenwick, Tara/Nerland, Monika (2014): *Reconceptualising Professional Learning: Sociomaterial Knowledge, Practices and Responsibilities*, London: Routledge.
- Gherardi, Silvia (2011): "Organisational Learning: The Sociology of Practice." In: Mark Easterby-Smith/Marjorie A. Lyles (eds.), *Handbook of Organisational Learning and Knowledge Management*, Chichester: John Wiley & Sons, pp. 43-65.
- Gherardi, Silvia/Strati, Antonio (2012): *Learning and Knowing in Practice-Based Studies*, Surrey: Edward Elgar.
- Hager, Paul/Lee, Alison/Reich, Anne (2012): *Practice, Learning and Change: Practice-theory Perspectives on Professional Learning*, Netherlands: Springer.
- Hammersley, Martyn/Atkinson, Paul (2007): *Ethnography: Principles in Practice*, London: Routledge.
- Harper, Douglas (2002): "Talking About Pictures: A Case for Photo Elicitation." In: *Visual Studies* 17/1, pp. 13-26.
- Jensen, Karen/Lahn, Leif/Nerland, Monika (eds.) (2012): *Professional Learning in the Knowledge Society*, Rotterdam: Sense Publishers.
- Knorr Cetina, Karin (1997): "Sociality With Objects: Social Relations in Postsocial Knowledge Societies." In: *Culture & Society* 14/4, pp. 1-30.
- Latour, Bruno (1999): "On Recalling ANT." In: John Law/John Hassard (eds.), *Actor Network Theory and After*, Oxford: Blackwell, pp. 15-25.
- Latour, Bruno (2005): *Re-Assembling the Social: An Introduction to Actor-Network Theory*, Oxford: Oxford University Press.
- Marcus, George (2008): "The End(s) of Ethnography: Social/Cultural Anthropology's Signature Form of Producing Knowledge in Transition." In: *Cultural Anthropology* 23/1, pp. 1-14.
- Massey, Doreen (2005): *For Space*, London and Thousand Oaks: Sage Publications.
- Mol, Annemarie (2002): *The Body Multiple. Ontology in Medical Practice*. Durham: Duke University Press.
- Nicolini, Davide (2009): "Articulating Practice Through the Interview to the Double." In: *Management Learning* 40/2, pp. 195-212.
- Nicolini, Davide (2013): *Practice Theory, Work and Organisation*, Oxford: Oxford University Press.
- Orlikowski, Wanda J. (2007): "Sociomaterial Practices: Exploring Technology at Work." In: *Organization Studies* 28, pp. 1435-1448.

- Osberg, Deborah C. (2008): "The Logic of Emergence: An Alternative Conceptual Space for Theorizing Critical Education." In: *Journal of the Canadian Association for Curriculum Studies* 6/1, pp. 133-161.
- Pink, Sarah (2011 [2007]): *Doing Visual Ethnography*, London: Sage.
- Schatzki, Theodore, R. (2001): "Introduction: Practice Theory." In: Theodore R. Schatzki/Karin Knorr Cetina/Eike von Savigny. (eds.), *The Practice Turn in Contemporary Theory*, London: Routledge, pp. 1-14.
- Sørensen, Estrid (2009): *The Materiality of Learning: Technology and Knowledge in Educational Practice*, Cambridge and New York: Cambridge University Press.