

Performative ontologies

Sociomaterial approaches to researching adult education and lifelong learning

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Abstract

Sociomaterial approaches to researching education, such as those generated by actor-network theory and complexity theory, have been growing in significance in recent years, both theoretically and methodologically. Such approaches are based upon a performative ontology rather than the more characteristic representational epistemology that informs much research. In this article, we outline certain aspects of sociomaterial sensibilities in researching education, and some of the uptakes on issues related to the education of adults. We further suggest some possibilities emerging for adult education and lifelong learning researchers from taking up such theories and methodologies.

Keywords: sociomaterial; actor-network theory; complexity theory; adult education; lifelong learning

Introduction

While in some parts of the adult education literature sociomaterial analyses have only recently begun to appear, these approaches have become reasonably familiar in related fields, such as higher education, organizational learning and practice, workplace learning, and e-learning/mobile learning. Researchers have developed sociomaterial approaches in order to reclaim materials and materiality in social life, and rethink their relations within education. Environment, other animals, objects and artefacts are treated as integral to the enactment of human existence and social life rather than as simply background context or tools. This theoretical work has entailed engagement with research in the physical sciences and related areas, where the nature of matter is a central question, as to examine the social without the material is argued to work with a

limited concept of society. The rethinking is linked to wider efforts in the social sciences to develop non-foundationalist and non-representational ways of researching the social: treating the “social” as less a bounded category and more itself an effect of sociomaterial practices. Here research is enacted from a performative ontology rather than the more characteristic representational epistemology that informs much research.

In this article, and drawing upon previous work (Fenwick & Edwards, 2010; Fenwick, Edwards & Sawchuk, 2011), we argue that such approaches open promising avenues for research in the broader terrain of adult education and lifelong learning. We also believe that this is normatively and politically important given the relative impotence of many existing forms of research critique, which as Latour (2004) has argued, have “run out of steam”. Our contention is that sociomaterial approaches to research offer opportunities for more engaged performative and practice-focussed forms of educational practices, even if such engagements become less certain, based upon what one of us has argued to be forms of conditionality, fallibility and responsibility (Edwards, 2012). We offer these as alternatives to trends in adult education research that have focused on notions of, for instance, transformative learning, emancipatory education, communities of practice and biographical research. While such work represents honourable traditions within adult education research, we would argue that most such work places human practices *within* a material context rather than exploring the material and human as mutual constituent enactments of the social.

There is a long established tradition of researching the material aspects of education, from the design of desks to the built environment of institutions (Lawn & Grosvenor, 2005). Indeed, Dewey’s (1938) influential conception of learning emerging through transactions between an inquiring learner and objects of the environment could be argued to have inaugurated a sociomaterial view of education. Other influential researchers of learning, such as Piaget and Vygotsky, could be said to have theorized humans learning as active agents in the material world. Here practice – that is, *doing* – is not ontologically separable from learning and human development but is the very substance of it. Forms of materialism are central also to many educators concerned to address issues of inequality and power in education, drawing upon Marxist, feminist and critical theory traditions of theorizing.

However, what is material is often taken to be the background context against which human educational practice takes place or within which it sits, and material artefacts are often taken to be simply tools that humans use or objects they investigate. In other words, even where the material is a matter of concern, it is not necessarily well theorized and humans are separated from the material rather than the material being integral to being human. While giving a focus to the materiality of education therefore, many such approaches still tend to privilege the intentional human subject, which is assumed to be different or separate from the material; the material is the non-human, the thing waiting to be used and animated by human intention and agency. Sørensen (2009, p. 2) argues therefore that there is a ‘blindness toward the question of how educational practice is affected by materials’. She suggests that its consequence is to treat materials as mere instruments to advance educational performance. In her study of the materiality of learning, she shows how everyday educational activity and knowing are critically shaped through and not simply by the material. She argues that materiality is not consolidated within artefacts, but is distributed, such that social as well as physical processes can be understood as material. For her, it is this *relational materiality* that is often overlooked in educational research where the learning human subject is often taken as the foundational object of study.

For this discussion, we have chosen to focus on two different arenas within which sociomaterial studies have been situated: complexity theory, and actor-network theory (ANT). Before we do however, it is important to draw attention to the many other research approaches that may be called sociomaterial that also have traction in fields related to adult education and lifelong learning, particularly work and learning: such as aspects of cultural-historical activity theory (CHAT) and certain spatiality theories (see Fenwick et al., 2011), and practice-based theories advancing concepts of knowing-in-practice (see Hager, Lee & Reich, 2012). A small but active field of research in education calling itself materialist feminism also has been working with concepts from Deleuze to explore what emerges in engagements with matter and learning (e.g. see Alaimo & Hekman, 2008). Space precludes an elaboration of these in this article. Our concern is what seems to be a tendency to position each of these broad approaches as bounded and discrete. We prefer to discuss them as “arenas” because these can be considered sites of contestation and the performance of overlapping ideas. Each arena represents a heterogeneous multiplicity of theories, or at least widely divergent uptakes of similar theoretical resources, so referring to each as a singular theory is problematic. Although each has been called a “theory”, most have featured debates criticizing this representation. Also problematic is the ocularcentric term of “perspective”, “lens” or “view”, to represent these explorations. Researchers in these arenas tend to emphasize knowing as enactment and experimentation rather than as “seeing” or as representation (Edwards, 2012). In fact, they often work to reveal the practices through which things become visible, conceptualizing knowledge, capabilities and subjectivities as emerging simultaneously in webs of interconnections among heterogeneous entities: human and non-human, social discourses, activities and meanings, as well as material forces, assemblages and transformations. There is also debate about the extent to which these arenas are theoretical alone and/or methodological. For example, Latour (1999) has argued that ANT is more a methodology than a theory and one which he locates within the tradition of ethnomethodology. However, not all theoretically informed ANT studies are ethnomethodologies. To write of the sociomaterial is not to be able to offer a bounded definition, as it is itself enacted through a range of relational practices. Our selection is illustrative rather than exhaustive.

In the hands of educational analysts, a rich body of literature has arisen that suggests useful interventions related to education. Working within these arenas, researchers have shown possibilities for alternative enactments of researching policy, curriculum, identity, learning, and knowledge, and different ways to approach pedagogic interventions. This article examines the educational understandings offered by certain sociomaterial approaches. The article is in three sections. First, we discuss some of the important contributions of these approaches in existing research on aspects of adult education and lifelong learning. Second, we offer a brief introduction to the two arenas of actor-network theory and complexity theory in terms of their central principles and approaches. Third, we draw out general themes for consideration and the ways in which educational research can add to sociomaterial theorizing as well as draw upon it.

Researching adult education and lifelong learning sociomaterially

The uptakes of sociomaterial approaches have been many but divergent in adult education and lifelong learning. For instance, Mulcahy (2006, 2007, 2011, 2012) has long used ANT to query the stabilized categories that govern practices of vocational education and workplace learning. For instance, she (Mulcahy, 2011) challenges the

counter-positioning of work, education and learning through empirical analysis of pre-service teachers in their practice placements, showing how work and education are mutually constituted material practices. Similarly, Thompson (2012) examines the informal learning of self-employed adults, also using ANT to challenge notions of online community and show the array of distributed materials and material networks that produce learning and participation. Some have used sociomaterial approaches in professional adult education: Bleakley (2012) experiments with its implications for rethinking the nature of evidence, illness and medical learning in practice. Sociomaterial analyses have been used to better understand complex changes in practice and work conditions, from inter-professional work to contradictory knowledge sources and standards (Fenwick, Jensen & Nerland, 2012). Others have focused on assessment in adult education. Fenwick (2010, p. 170) examines the materialities of assessment in various contexts of adult education to understand the ‘complexities of calculation as it is enacted through heterogeneous networks, but also the spaces of non-calculation that can be found or torn open to allow more freedom of play’. In the arena of adult literacy Hamilton (2009) and Clarke (2002) have both adopted ANT questions to examine the powerful sociomaterial assembling processes that order learners’ identities and knowledge, and the cracks that open possibilities for transgressive and subversive action within these assemblings. In relation to social movements, analysts have theorized the problem of agency when starting with an assumption that these movements are effects produced through material and social assemblages (Passoth, Peuker & Schillmeier, 2012).

Perhaps one of the earliest examples of, in particular, early ANT being drawn upon to study higher education is the work of Nespors (1994). In his exploration of teaching, learning and curriculum in undergraduate studies in Physics and Management in an American university, he examines the ways in which students and materials are organized in space and time and the implications of this both for knowledge and knowledge-building practices, and also for subjectivity. He illustrates that the different practices associated with the two subject areas result in different subjectivities, networks and representational practices. In other words, learning entails ways of being, ways of acting, ways of feeling, ways of interacting, ways of representing, as well as ways of knowing. For Nespors, these emerge through the materializing networks and networking practices in which people enrol and the translations to which they are subject. These are network effects, which he traces in great detail. The uptakes and the foci of research therefore are diverse within the broad terrain of adult education and lifelong learning, but they share the concern to theorize educational issues sociomaterially as arising within performative ontologies.

They provide conceptual resources to trace both the patterns as well as the unpredictability that makes educational activities possible. They promote methods by which to recognize and trace the multifarious struggles, negotiations and accommodations whose effects constitute the “things” in adult education: “learners”, “facilitators”, “learning activities and spaces”, “knowledge representations” such as texts, pedagogy, content, and so forth. Rather than take such concepts as foundational categories, taken for granted and naturalized, they trace these as themselves effects of heterogeneous sociomaterial relations (Latour, 2004). This challenges assumptions that a subject is separable from an object, or a knower from the thing that is known, and in some instances that a learner is necessarily human. Matter and meaning are taken to be interwoven and representation, based on a fundamental separation of subject and object, a problem (Barad, 2007). Yet education precisely tends to be often representational in its assumptions and practices, focussed on the development of the human subject and

their cognitive acquisition of ideas. In other words, education is assumed to enact primarily learning as representation, representing objects to subjects. Without the separation of matter and meaning, there is no rationale for much of educational practice as we know it. In a subject such as education where the human is centred as an object of study and knowledge a representation through which one learns about something, this can be unsettling.

A sociomaterial sensibility decentres the subject. Drawing on these arenas can interrupt understandings of knowledge, learning and education as solely social or personal processes, and insist upon attending to the material that is enmeshed with the social, technical and human. In the most radical expression of this approach, things are performed into existence in webs of relations. The central premise is, as Orlikowski (2007, p. 1435) puts it, ‘the constitutive entanglement of the social and material in everyday life’. All things – human, and non-human, hybrids and parts, knowledge and systems – emerge as *effects* of connections and activity. There are no received categories. The shift here is what Jensen (2010, p. 7) characterizes as ‘from epistemology and representation to practical ontology and performativity’. The question of producing knowledge and learning shifts from a representational idiom, mapping and understanding a world that is “out there” onto the “in there” of the human subject, to a view that the world, of which humans are a part, that is doing things, full of agency. This is the view that Latour and Callon proposed when they suggested that researchers need to be symmetrical in considering who *acts* on the world. Not only humans act, because non-humans act on and with humans. Human action requires the non-human, the material. Human agency is the effect of particular distributions and accumulations enacted through such assemblages. This view

multiplies the potentially relevant actors and force attention on their differences and relations. The aspiration is to thereby facilitate more nuanced analyses of how humans and things (broadly construed) together create, stabilize and change worlds. Analyses, in other words, that are sensitive to human and nonhuman activities as *practical ontology*: efforts to concretely shape and interrelate the components that make up the worlds they inhabit. (Jensen, 2010, p. 5)

In education, writers like Sørensen (2009) are increasingly arguing not just for greater attention to materiality, but for this more symmetrical approach, where materiality co-constitutes the practices that emerge. Waltz (2006) claims that in educational analyses, material things too often are denied their vitality. Materiality is subsumed by human intention, design, and drive, and treated merely as things representative of human ends. This hides the qualities and contributions of material entities themselves, including the materialities of human beings, particularly the ways they act within educational processes. Texts, for example, exert force. Depending on their form, they can enact certain pedagogical activities and sequences, align curricula across space and time, limit the teacher’s academic freedom, and affect student funds. They generally function as ‘co-conspirators, law-enforcement officers, administrators, racists, quality control agents, seducers, and investment advisors’ (Waltz, 2006, p. 57).

The point is that material things are performative and not inert; they are matter and they matter. They act together with other types of things and forces to exclude, invite, and order particular forms of participation in enactments, some of which we term “adult education” and/or “lifelong learning”. What then is produced can appear to be policy, or gender identity, or expertise, or a social structure such as racism. A focus on the sociomaterial therefore helps us to trace the heterogeneous relationships holding together these larger categories, tracing their durability as well as their ephemerality.

From this approach, no anterior distinctions, such as human beings or social structures, are presupposed.

Consider the concept of learning, central in educational discussions and extremely slippery in meaning and enactment. It is by now a commonplace in research to understand learning as more than the purely individual, cognitive and acquisitive process that has driven some approaches. Conceptions of learning have long acknowledged the importance of transactions among concepts, language, cultural mediation, and experimentation with environmental objects. Notions of learning as socio-cultural participation, embedded in particular joint activity, tools and routines have become ubiquitous in educational writings that suggest less instruction and more scaffolding of active processes as a pedagogic approach. However, such conceptions still tend to focus on individual learning subjects, and on their particular development through the processes of mediation and/or participation. What is placed in the background is how the entities, knowledge, other actors, and relations of mediation and activity – all the forces directly engaged in learning activities – are also being brought forth in practices precisely *as* learning. Learning here is a materializing assemblage and not simply a cognitive achievement or way of interacting. It is through the being-together of things that actions identified *as* learning, become possible. Thus teaching is not simply about the relationships between humans but is about the networks of humans and things through which teaching and learning are translated and enacted as such. They do not exist and cannot be identified as separate from the networks through which they are themselves enacted. They are not pre-existing transcendental entities or processes but immanent assemblages. We therefore begin to identify different research questions emerging from these arenas as well as particular theories and methodologies, questions which focus on how phenomena emerge, but which go beyond many forms of existing social constructions, which assume multiple perspectives on a single world out there. Research influenced by sociomateriality adopts the notion of many worlds, and multiple ontologies, enacted through the different forms of material assemblings.

Complexity and actor-network theories as sociomaterial arenas

While deriving from very different theoretical roots and premises, sociomaterial arenas bear some important resemblances. First, they take *whole network relations* into account regardless of what small slice of material or activity has been chosen as a primary focus for study. They explore the webs of entangled human/non-human actions, matters and meanings that give rise to and emerge from networks, and acknowledge the processes of boundary-making, boundary-marking and exclusion that establish what we take to be objects and systems, and their internal elements or objects with properties. Second, they focus on closely tracing the formations and stabilization of elements that are produced, reinforced or transformed by subjects that emerge with/in a particular activity. That is, they trace the *relational among non-human as well as human* parts of the system, emphasizing both the heterogeneity of elements and the need to focus on relations, mobilities and mediations, not separate things or separate individuals. Third, they understand human knowledge and learning in the network to be embedded in *material action and inter-action (or intra-action)*, rather than focusing strictly on internalized concepts, meanings and feelings of any participant. In other words, they do not privilege human consciousness or intention in any conventional sense, but trace how knowledge, knowers and known (representations, subjects and objects) emerge together with/in activity as “knowing locations” (McGregor, 2004). Finally, these approaches trace the

orderings and disorderings that become entities. They show the material and relational workings through which hybrid assemblings that produce identities, institutions, bodies of knowledge, practices, radical movements etc become stabilized and powerful, or transformed, reconfigured, distorted, or dissolved. Hybridity and mess are therefore the norm (Latour, 1993) and the focus of research. Making sense is a reduction to the singular when all is multiple performances.

Complexity theory

Complexity theory is actually a heterogeneous body of theories originating in evolutionary biology, mathematical fractals, general systems theory, cybernetics, and so on. The present discussion draws from analysts who have theorized complexity theory in terms of human and organizational learning (e.g. Davis & Sumara, 2006; Stacey, 2005). Complexity theory provides an approach to understanding learning processes in a system such as a work organization. The first premise is that the systems represented by person and context are inseparable, and the second that change occurs from emerging systems affected by the intentional tinkering of one with the other. The key concept is *emergence*, the understanding that in complex adaptive systems, phenomena, events and actors are mutually dependent, mutually constitutive, and actually emerge together in dynamic structures.

Davis and Sumara (2006), among others, have drawn upon these concepts to research human learning, showing how environment and learners emerge together in the process of cognition. Elements that come to comprise a system interact according to simple rules that are recursively re-enacted. Elements often couple, in a process of co-specification. As each element interacts and responds within the activity, the overall shape and direction of the system shifts, as does the emerging object of focus. Other elements are changed, the relational space among them all changes, and the looping-back changes each element's form and actions. The resultant coupling changes or co-specifies each participant, creating a new transcendent unity of action and identities that could not have been achieved independently. These interactions are recursive, continuing to elaborate what is present and what is possible in the system. They also form patterns all by themselves. They do not organize according to some sort of externally imposed blueprint but are *self-organizing*. Through the ongoing processes of recursively elaborative adaptation, the system can maintain its form without some externally-imposed discipline or organizing device, such as hierarchical management.

In education, people constantly influence and adjust to each other's emerging behaviours, ideas, and intentions as well as with objects, furniture, technologies, etc, through myriad complex interactions and fluctuations. A whole series of consequences emerge from these micro actions. Most of this complex joint action leaks out of individual attempts to control what they are doing. No clear lines of causation can be traced from these interactions to their outcomes, because at any given time among all these interconnections, possibilities are contained in the system that are not visible or realized. It is for this reason that Freud described education as an impossible practice, as its ends cannot be mandated (Edwards, 2008). This means, among other things, that humans are fully nested within and interconnected with many elements of the systems comprising them and in which they participate. They are not considered to be autonomous, sovereign agents for whom knowledge can be acquired or extracted.

Overall, in complexity theory knowledge and action are understood as continuous invention and exploration, produced through relations among consciousness, identity, action and interaction, objects and structural dynamics. New possibilities for action are constantly emerging among these interactions, and cognition occurs in the possibility

for unpredictable shared action. Knowledge or skill cannot be contained in any one element or dimension of a system, for knowledge is constantly emerging and spilling into other systems. No actor has an essential self or knowledge outside these relationships. Thus, for example, an organizational change initiative would focus on enabling connections instead of training individuals to acquire understanding of the new policy. These are connections between this initiative and the many other initiatives likely to be lurking in the system, between parts of the system, between the initiative and the system's cultures, and between people, language and technologies involved in the change. It would encourage experimentation among people and things involved in the change, and would focus on amplifying the advantageous possibilities that emerge among these connections as people tinker with the things and language involved. Learning is defined as expanded possibilities for action, or engaging in more sophisticated and flexible action (Davis & Sumara, 2006).

When examining different arenas of sociomateriality, complexity theory provides a rich analysis of the *biological* (as well as social, personal, cultural) flows inherent in materialization processes. It highlights the elaborate intertwining of human/non-human elements, and the non-linear simultaneous dynamics and conditions which produce *emergence*. The system in complexity theory is an effect produced through self-organization via these dynamics and is continuously adaptive. Studies are able to model system patterns in various scalar spaces as they interact, shift and change. Knowledge (e.g. new possibilities, innovations, practices) emerges along with identities and environments when the system affords sufficient diversity, redundancy and multiple feedback loops. Diversity is not to be managed towards producing greater homogeneity, as some approaches to workplace learning might advocate, but by being interconnected. In multiplying connections, different possibilities emerge. In elaborating this point, Davis and Sumara (2006) explain that difference in an identified system needs ways to become visible – the conditions must enable the enactment of difference – which is often not the case. As diverse elements become enacted, they could also be able to interconnect through overlap. In classrooms or organizations, emergence can be enabled where there is diversity and constraints (purposes and rules of engagement) by amplifying difference and perturbations, decentralizing organizing processes, encouraging continuous interaction, and ensuring ongoing feedback among various elements/sites (Davis & Sumara, 2006; Stacey, 2005). In this way, complexity theory becomes not only a way of enacting research, but also for developing pedagogical practices.

Actor-network theory

Actor-network theory has emerged from the social rather than natural sciences, in particular the study of science and technology, both in terms of knowledge and innovations. Yet it shares similar concerns with complexity theory. Proponents of ANT claim it is not a theory but a sensibility, indeed, many diffused sensibilities that have evolved in ways that eschew its original tenets. Their shared commitment is to trace the process by which elements are connected together and manage to *hold* together, to assemble collectives, or networks. These networks produce force and other effects: knowledge, identities, rules, routines, behaviours, new technologies and instruments, regulatory regimes, reforms, learning and so forth. No anterior distinctions such as human being or social structure are recognized as foundational categories.

ANT takes knowledge generation to be a joint exercise of relational strategies within networks that are spread across space and time and performed through inanimate – e.g. books, mobile phones, measuring instruments, projection screens, boxes, locks –

as well as animate beings in precarious arrangements. Learning and knowing are performed in the processes of assembling and maintaining these networks, as well as in the negotiations that occur at various nodes comprising a network. ANT focuses on the minute negotiations that go on at the points of connection. Things persuade, coerce, seduce, resist, and compromise each other as they come together. They may connect with other things in ways that lock them into a particular network, or they may pretend to connect, partially connect, or feel disconnected and excluded even when they are connected. When anyone speaks of a system or structure, ANT asks, how has it been compiled? Where is it? What is holding it together? All things are assemblages, connected in precarious networks that require much ongoing work to sustain their linkages. ANT traces how these assemblages are made and sustained, how they order behaviours as well as space and objects, but also how they can be unmade and how counter-networks or alternative forms and spaces can take shape and develop strength.

Latour (1999) argues against any ontological separation between materiality and meaning as a rupture between the thing and its sign that are part of each object. He considers a central problem to be the “circulating reference” between words and world that attempts to transform matter, the objects of knowledge, into representations, as though there were justifiable a priori distinctions between mind/matter or object/sign. He, like Hacking (1999) and Barad (2007), is therefore critical of social constructivists as well as realists in assuming that materiality and representation are separate realms. The important point is that ANT focuses not on what texts and other objects represent or mean, but on what they do. And what they do is always in connection with other human and non-human things. They are what he refers to as gatherings rather than discrete objects with properties. Some of these connections link together to form an identifiable entity or assemblage, which is referred to as an “actor” that can exert force. “University”, for example, represents a continuous collaboration of machines and information, routines, supplies, bodies and their capacities, techniques and timetables, gazes, safety rules, legislation and so on. This university is both an assemblage or network of things that have become connected in a particular way, and an actor itself that can produce fears, policies, pedagogies, forms of study and resistances to these forms – hence, actor-network. And the gatherings that have become part of this actor-network are themselves effects, produced by particular performances with one another.

ANT analyses show how the entities that we commonly work with in educational research – classrooms, teaching, students, knowledge generation, curriculum, policy, assessments, inequities, reform – are in fact gatherings of myriad things that order and govern educational practices. Yet, these assemblies are often precarious networks that require a great deal of ongoing work to sustain their linkages. The focus is on how things are enacted and the practices through which this is achieved rather than attempting to explain why they are the way they are. The former always contain the possibilities for difference and multiplicity rather than being foundationally grounded.

Researching sociomateriality

There is a danger in becoming overly fascinated with conceptions that trace complexity and assemblings, without asking how such analysis is any more productive in understanding and responding to educational concerns. While sociomaterial approaches offer researchers different ways of engaging and intervening in educational issues, educational researchers also bring important questions to sociomaterial arenas around core questions of knowledge, pedagogy, and purpose. What forms of knowledge are

produced in current educational arrangements, what productive forms of knowledge are possible, and what engagements can develop these? What is competency, and what is expertise, in sociomaterial practices? How is pedagogy achieved sociomaterially, and what effects are produced by different pedagogies? How are educational purposes produced (or resisted, defused, undermined) through different heterogeneous assemblages, and how can these be influenced? How can we conceptualize “good education” in a sociomaterial orientation? How can we understand and promote productive enactments of educational responsibility? What does education for equity and justice look like if we approach it as vital materiality, and how can it be promoted?

Adult educators have for some time worked with notions of situated learning, accepting metaphors of learning as more about participation than acquisition. But who and what participate, and how, with what effects? Sociomaterial orientations offer more fine-grained analyses of participation than are commonly undertaken in conceptions of communities of practice, as Nespor (1994) illustrated. Similarly, the concept of practice in education, while recently reclaimed in the so-called practice-based turn of learning (Hager et al., 2012), is a vast domain that needs more nuanced consideration: visible activity and invisible infrastructure, forms and purposes of knowing activity, and various practicing combinations of materials, meanings and energies that sociomaterial analyses can help us to appreciate.

Adult educators working within sociomaterial arenas also continue to raise the question of human subjectivity and meaning. They wonder if, when we move away from the individual, are we then in a world of techno-determinism? Or, from a different set of concerns, do these approaches simply remain at a systemic level that abstracts, or omits, the person and the personal that are crucial in education? For some, sociomateriality represents a post-human orientation. However, this is not an anti-human post-humanism where technological enhancements and digitized bodies are the nightmare of lost human dignity and subjectivity (Fukuyama, 2002; Hayles, 1999). Rather, this is a post-humanism that refutes the anthropomorphic centrality of human beings and human knowledge in defining the world and its relations. It accepts the value of transgressing boundaries and disrupting uniform ideas about what it means to be human. It even may suggest expansion of human being-ness beyond current naturalized limitations of physical body and brain-based intelligence. To be human is enacted through materializing practices. Here, the language of human/nonhuman (like material/immaterial, and natural/social) can create problematic binaries. These have been critiqued in ANT debates (Fenwick & Edwards, 2010; Lee & Brown, 1994; McLean & Hassard, 2004), along with the paradox of anthropocentricity when human researchers assemble accounts assuming to speak for non-humans. The point is not to indulge in what McLean and Hassard (2004) call “symmetrical absurdity”, pretending to banish human meanings, subjectivities, desires, values and so forth from the process and representations of analysis. The point is to insist upon recognizing important influences in assemblages as emanating from nature, technology, objects and all manner of quarks, which may overlap and infuse what is human.

An important radical tradition in adult education has been devoted to empowering human beings to act agentially in promoting decency and justice and resisting inequity. However, when actors are understood to be assemblages of many things that are continually (dis-/re-)assembling, the focus shifts to understanding how and when these variously distributed human and non-human materials collectively generate exercises of power, consolidate or resist it and when they cannot. When agency is thus understood as a distributed effect produced in material webs of human and non-human assemblages, some argue that a more responsible, ecological politics is possible (Barad, 2007;

Bennett, 2010). But how can this be if agency is precisely about a human being becoming an agent (e.g. for social change)? How can we think about collective action when we have “agency without actors”? (Passoth et al., 2012).

“Agency”, which Callon (2005, p. 4) defines as ‘capacity to act and to give meaning to action’, is problematic for many sociomaterial analysts. Some refuse to use it altogether with its associations of human individuals’ intention, initiative and exercises of power. Others like Bennett (2010) and Callon (2005) write of agency as relational, possible only through assemblages. Barad (2003, 2007) calls this relational entwining “intra-activity”. Entities become linked through intra-actions, a term she uses to indicate the mutual constitution that occurs simultaneously with their joint activity. *Inter-action* suggests that entities are separate and pre-determined prior to their encounter. But in fact, argues Barad, complexity science shows that all entities (human and non-human) as well as their “relata” – the nature of the links through which they become related in some way – emerge together through their continuous *intra-activity*. Working with these ideas through feminist theory and quantum physics, particularly the physics of Neils Bohr, Barad develops a sophisticated conception of complex materiality that she calls “agential realism”. Here ‘the world is an ongoing open process of mattering through which “mattering” itself acquires meaning and form in the realization of different agential possibilities’ (Barad, 2003, p. 817).

However, in specific intra-actions, an “agential cut” is enacted that causes a boundary to appear. This boundary separates matter into distinct entities and identifies some relationship among them such as causality, or observer and observed – subject and object. An agential cut is realized through what Barad calls an apparatus of observation, which is a specific material-discursive configuration that is exercised in an act of agency. These apparatuses also emerge through other agential cuts. An agential cut is always a performance: the boundaries distinguishing knower, known and knowledge do not pre-exist the cut. Further, an agential cut can only be performed in a local moment and place. Agency emerges through iterative changes that are enabled in the dynamic openness of each intra-action. Those who draw upon these ideas in education and educational research, such as Hultman and Lenz Taguchi (2010, p. 538), propose approaches such as ‘diffractive seeing’ and ‘nomadic thinking’. The researcher (or teacher, or learner) learns to understand themselves as part of and activated by ‘the waves of relational intra-actions between different bodies and concepts (meanings)’ in active encounters with a things such as data. To read these encounters diffractively is to see how ‘you install yourself in an event of “becoming-with” the data’.

For adult education, this emergentist ontology radically calls into question the material separation of humans, objects and their relations, including the separation of entities and representations, in activities of learning and pedagogy. It also insists that the future is radically open, for at every local performance of intra-action, there is space for material-discursive agency. The important issues are not *where* agency is located or what kind of agency is human or non-human, but rather the profound uncertainty about the nature of action, and controversies about how agency is distributed. Some critical educators, like Holifield (2009) who writes from the perspective of environmental justice, argue that sociomaterial accounts are powerful precisely because they can register a range of competing accounts of agency. The aim is to understand not what agency *is* but how certain accounts of it become stabilized and their effects.

Questions of power and the normative inspire continuing debate among adult educators. Some approaches such as ANT have been critiqued for offering a flat ontology where nothing can be challenged and no standpoint for intervention formulated. However, other researchers have shown clearly that ANT traces very well

how powerful assemblages – whether ideas, institutions, machines or dictators – emerge and extend themselves. It is an approach that is precisely about intervention and experimentation given the performative ontology it enacts. Sociomaterial approaches can reveal materialist dynamics of oppression, exclusion, transgression and agonism that are at play but often overlooked in educational processes. They also can illuminate openings and ambivalences for entry, opportunities for interruption, and strategies for productive materialist coalitions. More importantly, as political philosopher Bennett's (2010, p.107) work shows, a materialist theory of democracy is enabled when we encounter the world 'as a swarm of vibrant materials entering and leaving agentic assemblages'. She follows the French philosopher Rancière in accepting that a political act not only disrupts, but also disrupts in order to radically change how people perceive the dominant partition of the sensible: the boundaries that distribute bodies so that some are visible as political actors and others ignored. However, Bennett asks, why is the power to disrupt limited to human speakers, and the power to provoke dramatic public perceptual shifts assumed to exclude non-humans?

We might then entertain a set of crazy and not-so-crazy questions: Did the typical American diet play any role in engendering the widespread susceptibility to the propaganda leading up to the invasion of Iraq? Do sand storms make a difference to the spread of so-called sectarian violence? Does mercury help autism? In what ways does the effect on sensibility of a video game exceed the intentions of its designers and users? Can a hurricane bring down a president? Can HIV mobilize homophobia or an evangelical revival? (Bennett, 2010, p. 107)

As Bennett concludes, when the sensible is repartitioned, and the regime of the perceptible overthrown, new tactics emerge for enhancing, or weakening particular arrangements of the public. This opens different possibilities for research and practice.

A final contribution of sociomaterial approaches is to debates around the difficulties of conducting research. Suchman (2007) explains that sociomaterial orientations constantly remind us that we are an integral part of the apparatus through which our research objects are made. Once we step outside a representational idiom of (re)searching phenomena, we must confront the ways in which our practices of research and knowing are specific material entanglements that participate in (re)configuring the world as research. Sociomaterial approaches offer two starting points for this. The first is a sensibility for, and a language for speaking about, both the order and the mess that are mutually enacted in the material swarms of educational worlds. The mess is the lumpy stuff that continually spills out of categorizations and models: a necessary hinterland of details, contingency and banality that so often disappears in a focus on what appears to be self-evidently important and significant in research. As Suchman (2007) has been arguing for over two decades, we keep trying to order the mess with prescriptive devices – typologies, plans, maps, procedures, and instructions – but these are in themselves practices that are mutually constituted of ordering impulses and messy hinterlands. Sociomaterial approaches emphasize responsible knowing, research that explicates the boundary-making and the exclusions crafted through its own processes, and that traces the entanglement of the researcher in the vital swarms of the researched. This is a fraught endeavour of course, particularly when a human researcher is, in the final representation, speaking for the swarms and when a "unit of analysis" is a gathering, raising ethical and political questions of where one stops to "cut the network" in following the actors (Strathern, 1996).

Concluding remarks

We have been arguing that sociomaterial approaches offer useful theoretical and methodological sensibilities and questions for adult educational researchers. Our interest here has been primarily in the emphasis on materiality offered by these approaches, which show how it is relational and distributed within webs of thought and activity, social and physical phenomena in education. Further, they offer methods for analyzing how materializing processes are bound up with assembling and reassembling policies and practices, subjectivities and knowledge. While very different in their points of departure and foci for analysis, these approaches analyze processes termed learning as phenomena of emergence and orderings within and across space-time. They show the interdependence of entities, which not only de-centres the knowing subject but also unseats idealizations of enterprising, autonomous knowers. Most important perhaps, these approaches have offered resources to understand and engage, both pedagogically and critically, with the unpredictability and impossibility of educational processes. They could be enacted to unpick the fragile stabilities of devices that appear to be immutable and to show the productive openings created.

A key contribution of them all is to de-couple learning and knowledge production from a strictly human-centered socio-cultural ontology, and to liberate agency from its conceptual confines as a human-generated force. Instead, agency as well as knowledge is understood to be *enacted* in the emergence and interactions – as well as the exclusionings – occurring in the smallest encounters. In these material enactments bursting with life, this “vital materiality”, or “material-discursive agency”, boundaries and properties of elements come into being, subjects and objects are delineated, and relations are constituted that produce force. Nothing is determined in advance of its own emergence. Therefore, (unknown) radical future possibilities are available at every encounter. This is attuned to certain traditions of adult education research and may enable the emergence of sociomaterial questions and sensibilities as a matter of concern in its enactments. But all this is conditional upon moving research from a focus on representation to a more experimental performative engagement with the materializing of practice.

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