

Postparadigmatic materialisms: a ‘new movement of thought’ for outdoor environmental education research?

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Abstract

Since at least the beginning of this century, the literatures of research methodology in the social sciences have increasingly focused on what are now being called *new empiricisms* and *new materialisms*. My purpose in this essay is to appraise the potential of these approaches for outdoor environmental education research. I begin by reviewing some of the ways in which outdoor and environmental education research has been conceptualised in the recent past, with particular reference to the practice of representing research in terms of paradigmatic distinctions. I argue that poststructuralist theorising, with which the new empiricisms and new materialisms have strong continuities, has never been accommodated by Kuhnian paradigmatic categories, and that these new movements are more usefully understood as arising from *postparadigmatic* thinking. I then provide a brief (and far from comprehensive) overview of some key characteristics of new materialist research approaches with particular reference to the utility of deploying Barad’s concept of *intra-action* and Deleuze and Guattari’s concept of *assemblage* in conceptualising research methodology and methods, and offer a selection of examples of how such approaches might inform outdoor and environmental education research, with particular reference to challenging anthropocentrism in these fields.

Introduction

My motivation for writing this essay arises, in large part, from my interest in pursuing a very similar question to one that Phillip Payne (2016) poses in the title of his capstone article for a recent special issue of *The Journal of Environmental Education*, namely, ‘What next? Post-critical materialisms in environmental education’.¹ I was both pleased and intrigued to note that Payne’s response to the ‘what next?’ question converges in many respects with recent advocacy for modes of thinking described in terms of ‘new empiricisms’ and ‘new materialisms’ (see, for example, St. Pierre, Jackson, & Mazzei, 2016) that have also captured my interest. Payne writes:

This new *movement of thought* concerns itself with ontology, and the status of the real and, subsequently, the epistemologies flowing from a ‘new’ material vitalism about the way the world *is*, and how we are *in* it. In its various guises, this movement may well reveal the historical complicity of ‘old’ Western Cartesian inert ‘thought’ about what it thought truly and rationally *mattered*, its presumptions, logics, and methods of reason (for example, Barad, 2007; Coole & Frost, 2010; Connolly, 2013; Latour, 2013; Shaviro, 2014). (Payne, 2016, p. 169; italics and quotation marks in original)

I share Payne’s interest in ‘what next?’ for environmental education, and more specifically for *outdoor* environmental education *research*, but I do not want to constrain my speculations by representing them in terms of familiar paradigmatic categories (such as critical or post-critical). To appraise possibilities for ‘what next?’ requires consideration of past and present movements of thought, so in this essay I will briefly review some of the ways that outdoor

environmental education researchers have thought about their practice, and the cultural materials on which they have drawn in so doing, before considering the possibilities for deploying new empiricist and materialist perspectives in this field.

I regret that Payne does not disaggregate the five sources he cites as examples of the ‘various guises’ taken by the ‘new movement of thought’ to which he refers. This ‘sandbag’ approach to citing sources (in which multiple sources are packed into parentheses at the end of a sentence) is commonplace in academic writing, but is not particularly informative because it invites readers to interpret what might be disparate sources as having a degree of homogeneity. Of the five sources cited, only William Connolly’s (2013) work is further elaborated in Payne’s (2016, p. 170) assertion that the collective thought of the contributors to the special issue ‘about “what next?” converges loosely on the need for new intellectual resources, vocabularies and grammars’:

William Connolly (2013) captures the broader mood well in his ‘ecology of late capitalism,’ where the processes of ‘planetary politics’ and, in particular ‘*role experimentations*’ in ‘*democratic activism*’ neatly capture the currents and morphologies expressed here... (Payne, 2016, p. 170; italics and quotation marks in original)

Payne provides no additional explanations for citing Barad (2007), Coole & Frost (2010), Latour, (2013) and Shaviro (2014) as exemplars of a ‘new movement of thought’ concerned with ontologies and materialisms, although I am sufficiently familiar with these authors not to dispute their relevance. Nevertheless, I was somewhat surprised that none of them were cited again in Payne’s (2016, p. 171) very useful elaboration of eight ‘major absences and silences relevant to the decolonizing of globalizing policy-making endeavors’. For example, as Serge Hein (2016, p. 132) notes, Barad ‘is arguably the most prominent figure in the new materialism’, and her work is manifestly relevant to at least three of the major absences and silences that Payne identifies, namely:

- *Agency*: a key chapter of Barad’s (2007) book is devoted to justifying and elaborating her concept of ‘agential realism’ (p. 132), which ascribes agency not only to humans but to matter as well. A significant implication for outdoor environmental education research is that agential realism ‘provides an understanding of the role of human and nonhuman, material and discursive, and natural and cultural factors in scientific and other social-material practices’ (p. 26). In other words, nature is agentic – it acts, and those actions have consequences for both the human and nonhuman world.
- *Ontological-epistemological*: Barad’s coinage of the term ‘ontoepistemological’ is frequently cited in discourses around the ‘new materialism’; For example, Sigrid Schmitz (2015, p. 69) writes: ‘With her onto-epistemological framework, Karen Barad highlights the multiple relations between matter (as an agential component), research practices, concepts, meaning making, and representations of knowledge in constituting phenomena’. Barad (2007, p. 409) writes: ‘The neologism “ontoepistemological” marks the inseparability of ontology and epistemology. I also use “ethico-onto-epistemology” to mark the inseparability of ontology, epistemology, and ethics’
- *Nature*: Barad (2007, p. 247) devotes a chapter titled ‘Quantum Entanglements: Experimental Metaphysics and the Nature of Nature’ to exploring positions on nature that Payne (2016, p. 175) addresses in terms such as ‘greater nuance and sensitivity to a range of nonhuman differences and othernesses within each of the constructions of “culture” and “nature” is warranted before that “simplistic/reductive” (Western) binary construction

is universally deconstructed and (overly) “hybridized” or, again, mashed at the discursive level of abstraction’.

From Kuhnian rhetoric to postparadigmatic diaspora

I have no quarrel with the majority of Payne’s explorations of the ‘what next?’ question, but I want to problematise one aspect of his characterisation of the ‘new movement of thought’ which arises in his reference to Bob Jickling’s (2016) contribution to the special issue:

In many respects, this current stream of thought is another braiding of the calls in EE from the 1980s for a ‘paradigm’ shift in education and research, a point touched upon by Bob Jickling through Kuhn, and implicit to the other contributors assembled here. Undoubtedly, it is an exciting (theoretical) time for environmental educators and researchers (p. 170).

To say that Jickling ‘touches on’ Thomas Kuhn’s (1962) popularisation of the term paradigm and the notion of paradigm shifts is something of an understatement (his précis of Kuhn’s thesis takes up more than 800 words of his essay), but his valorisation of Kuhn’s historical account of how scientific change occurs does not disclose the extent to which it has been contested. I am willing to admit that I was one of the environmental educators who called for a paradigm shift during the 1980s (N. Gough, 1987) but I have since found many reasons to sympathise with Nobel laureate Steven Weinberg who, as John Caputo (2000, p. 152) alleges, ‘criticizes Kuhn’s *The Structure of Scientific Revolutions* for offering no revolution at all but mostly just driving under the influence of an intoxicating word (“paradigms”)’ (see also Weinberg, 1988).

It is commonplace for commentators on trends and issues in outdoor and environmental education research to describe methods and methodologies by reference to paradigmatic categories. For example, Glyn Thomas, Tom Potter and Pete Allison’s (2009) comparative analysis of the refereed articles published in the *Australian Journal of Outdoor Education*, the *Journal of Adventure Education and Outdoor Learning*, and the *Journal of Experiential Education* between 1998 and 2007, categorises research based papers using the paradigms identified by Donna Mertens (2005), namely, postpositivist,² constructivist, and transformational, to which they add the category of action research (Thomas, Potter & Allison, 2009, p. 18).

Similarly, Robert Stevenson and Snowy Evans (2011) use the paradigms they identify as ‘positivist, interpretative and socially critical’ as one of five frames for their historical and comparative analysis of the distinctive characteristics of environmental education research in Australia during the decade of the 1990s. The results of their ‘paradigm frame’ analysis include:

The most common paradigm or conceptual orientation for examining and developing arguments in relation to environmental education issues over the 11 year period was socially critical theory... The dominant theoretical argument was grounded (explicitly or implicitly) in a paradigms frame (represented by 48 percent or almost half the articles), especially socially critical theory which was employed (more than the other non-positivist paradigms combined) to frame critiques of current conceptions of human-environment relationships and of environmental/sustainability education. (pp. 38-39)

I share George Marcus and Michael Fischer’s (1986, p. 233) view: ‘To still pose one paradigm against the other is to miss the essential character of the moment as an exhaustion

with a paradigmatic style of discourse altogether'. Those of us who found ourselves becoming combatants in what the late Nathaniel Gage (1989) lampooned as 'the paradigm wars' of the 1980s are likely to agree with Paul Atkinson, Sara Delamont, and Martin Hammersley's (1988, p. 233) cautions about 'the dangers of Kuhnian rhetoric. Commitment to paradigms also frequently leads to intolerance, fruitless polemic, and hypercriticism'. John Caputo's (1987) term, 'postparadigmatic diaspora' (p. 262), might help us to escape, exceed and complexify Kuhnian structures/strictures and engage in less adversarial approaches: 'this postmetaphysical lack of foundations, generates a new morality of civility and fair play' (Caputo, 1987, p. 262). Kuhnian paradigms might once have served as a useful transitional concept, but as Atkinson, Delamont and Hammersley (1988, p. 243) conclude, 'classifying research and researchers into neatly segregated "paradigms" or "traditions" does not reflect the untidy realities of real scholars...and may become an end in itself'.

For those of us with poststructuralist dispositions, a significant difficulty with Kuhn's rhetoric is that 'paradigm' is itself a structuralist concept predicated on an implicit model of the metaphorical equivalence of the physical and social constructions of our world(s). In this model, the sites (clay, sand, rock, water) on which physical objects rest are metaphorically equivalent to paradigms (deeply rooted cultural understandings of reality, nature and human nature). These material sites and conceptual paradigms underlie analogous frameworks (the footings and substructures of buildings are understood as equivalents of the cultural, ethical and moral norms that support social constructions of 'reality') which in turn support the superstructures of buildings, roads, signs and fences that constitute physical architecture and the analogous language/symbols, customs, laws and institutions of our social 'architecture'. However, as Cleo Cherryholmes (1988, p. 11) argues, poststructuralist thought is sceptical and incredulous about the possibility of metanarratives and therefore questions the structuralist view that some narratives can be understood as providing 'grounds' or 'foundations' for others. Thus, for example, Doreen Massey (2003, p. 77) draws attention to philosophers such as Richard Rorty (1979), who 'challenge the view that language is, or can demonstrably be, a "mirror of nature"'. [Rorty's argument] is that we cannot connect with a world of experience outside language; that what we have available to us, as researchers, is language "all the way down"'.

With some notable exceptions, poststructuralist orientations to outdoor and environmental education research have not had a particularly high profile in the journals that represent these fields. Thomas, Potter and Allison's (2009) comparative study of three journals in the related fields of outdoor education, adventure education, and experiential education makes no mention of poststructuralist research (although Zink & Burrows' 2006 exploration of what Foucault's work might offer to outdoor education was published within the period they analyse). For the period 1990-2000, Stevenson and Evans (2011) identify only three of the thirty two *AJEE* articles that they analyse within the 'paradigms frame' as adopting a poststructuralist standpoint (viz. N. Gough, 1991; Barron, 1995; Ferreira, 1999), although this was the decade during which Annette Gough (1994, 1997, 1999a, 1999b) pioneered feminist poststructuralist research in Australian environmental education research and (N. Gough, 1993, 1994, 1999) published further environmental education research inflected by poststructuralism in international forums. Since 2000, poststructuralist scholars foregrounded in *AJEE* include Derrida and Deleuze & Guattari (N. Gough, 2006; Stewart, 2011) and Jean-Luc Nancy (A. Gough & N. Gough, 2016b). Stewart's (2015, p. 1177) recollection of his first encounter with Deleuze and Guattari's concepts in 2004 exemplifies the relatively late uptake of poststructuralist perspectives by outdoor education researchers:

My first introduction to Deleuze and Guattari's rhizomatic approach to thinking was through the work of Gough and Sellers (2004). I remember at the time being at once

confounded and captivated by its non-conventional, non-linear, multiplicity of connections. Rhizomes have subsequently transformed aspects of my teaching and thinking about education; much of my pedagogy has become *rhizo-pedagogy*.

Poststructuralist perspectives in environmental education research became more evident in international forums during the 2000s, exemplified by contributions from M. J. Barrett (2005, 2006), Annette Gough and Hilary Whitehouse (2003) N. Gough (2000, 2009, 2015a), Marcia McKenzie (2005) Rob O'Donoghue and Heila Lotz-Sisitka (2005) and Constance Russell (2005).

Nevertheless, during the 1990s, and into the following decade, many environmental philosophers, advocates, and educators appeared to be antagonistic to, and/or dismissive of, poststructuralism and deconstruction (or anything they associated with postmodernism). Some were downright vicious, including Ariel Salleh (1997, p. xi) who saw postmodernism as a 'castrated academic philosophy'. Others, like Carolyn Merchant (2003, p. 201), were more politely suspicious: 'Although deconstruction is an important analytical tool, I argue that realism... is an important counter, or other, to deconstruction's focus on language'. Somewhere between these positions, Charlene Spretnak (1999, pp. 64-65) offered the following caricature of 'post' scholarship:

The critical orientation known as 'deconstructive postmodernism,' 'constructionism,' or 'constructivism' asserts that there is nothing but 'social construction' (of concepts such as language, knowledge systems, and culture) in human experience... The philosophical core of deconstructive postmodernism is the rejection of any sense of the 'Real'.

This is not the place for a detailed critique of the rhetorical strategies these authors used to distort the views of those they discredit (N. Gough & Leigh Price, 2004, provide such a critique), but it must be noted that Spretnak's insinuation that poststructuralism and deconstruction rejects *any* sense of the 'Real' distorts the positions of the many philosophers – structuralists *and* poststructuralists, constructionists *and* deconstructionists – who share the view that the objects and meanings that constitute our existential 'reality' are social constructions. I do not interpret these philosophers as questioning *belief* in the real but, rather, *confidence in its representation*. As Rorty (1979, p. 375) puts it, 'to deny the power to "describe" reality is not to deny reality', and 'the world is out there, but descriptions of the world are not' (Rorty, 1989, p. 5). In other words, representations of the material world are products, artifacts or effects of particular sets of historical and linguistic practices.

Although less adversarial than the above authors, William Scott and Stephen Gough (2004), in an otherwise thorough synthesis of diverse perspectives on learning and sustainable development, very largely ignore the possibilities and potentials afforded by poststructuralism and deconstruction for thinking imaginatively and creatively about socio-environmental problems. Indeed, they completely ignore deconstruction and make only two cursory references to poststructuralism, firstly in a section on 'Language and understanding; language and action' in which they conflate 'post-modern' and 'post-structuralist' (p. 26), and secondly in a section titled 'Literacies: the environment as text' in which they unquestioningly reproduce an assertion they attribute to Andrew Stables (1996): 'As structuralists and post-structuralists have pointed out, one way of looking at the world is to say that *everything* is a text' (p. 29; emphasis in original). This seems to be an extension (and, I argue, a misrepresentation) of Jacques Derrida's (1976, p. 163) often-quoted assertion that 'there is nothing outside the text', which is in turn a misleading translation of '*Il n'y a pas de hors-texte*' (literally, 'there is no outside-text'). As Tony Whitson (2006) succinctly explains, Derrida is not, as some of his critics insist, denying the existence of anything outside of what

they (the critics) understand as texts; his claim is not '*il n'y a rien hors du texte*' (that the only reality is that of things that are inside of texts). Rather, Derrida's point is that texts are not bounded by an inside and an outside, or '*hors-texte*': 'nothing is ever outside text since nothing is ever outside language, and hence incapable of being represented in a text' (Derrida, 1976, p. 35)

A materialist turn: Karen Barad's agential realism and 'intra-action'

Environmental philosopher Jim Cheney (1989, p. 120) seems to anticipate a materialist turn in his assertion that 'The truth of "It's language all the way down" must be understood in light of the equal truth of "It's [material] world all the way up" – though it gets perverse in its upper reaches as the world as language closes in on itself, becoming inbred and pretending to totalization and foundationalist philosophy'.

As noted above in relation to Payne's (2016) discussion of the absence and silence around agency in the literature of environmental education research, Barad's (1997, p. 132) concept of *agential realism* has significant implications for outdoor environmental education research. In an introduction to her rationale for agential realism, she insists that materiality is at least as significant as language for understanding the objects of our inquiries:

Language has been granted too much power. The linguistic turn, the semiotic turn, the interpretative turn, the cultural turn: it seems that at every turn lately every 'thing' – even materiality – is turned into a matter of language or some other form of cultural representation. The ubiquitous puns on 'matter' do not, alas, mark a rethinking of the key concepts (materiality and signification) and the relationship between them. Rather, they seem to be symptomatic of the extent to which matters of 'fact' (so to speak) have been replaced with matters of signification (no scare quotes here). Language matters. Discourse matters. Culture matters. There is an important sense in which the only thing that doesn't seem to matter anymore is matter (Barad, 1997, p. 132).

At first sight, Barad's words might seem to be music to the ears of researchers who remain suspicious of 'post' positions, and this seems to be how some environmental education scholars understand them. For example, Eve Tuck and Marcia McKenzie (2014, p. 15) introduce their discussion of 'the new materialist turn' by stating that the 'recent new materialist, neo-materialist, or ontological turn has emerged through orientations that object to the hegemony of the linguistic paradigm in poststructuralism'. I suggest that this assertion might be misleading in at least two ways. Firstly, as noted above, poststructuralists tend to eschew the structuralist concept of 'paradigm'. Secondly, given that poststructuralism is not a unitary theory but a multiplicity of theoretical positions marked by their rejection of totalising, essentialist, foundationalist metanarratives, I doubt that any single element of this multiplicity could be so dominant as to be considered 'hegemonic'. Thus, although Tuck and McKenzie (2014, p. 15) acknowledge new materialism's 'intellectual roots in Continental philosophy' their account of its emergence risks distorting the positions taken by the many new materialist theorists who acknowledge their continuities with (and indebtedness to) the poststructuralist thought of Derrida and Deleuze, among others. I suspect that Adeline Johns-Putra (2013, p. 126) might be closer to the mark in suggesting that various formulations of new materialism, including Barad's agential realism, 'have challenged the linguistic or social constructivism that tended to dominate critical theory *after* poststructuralism' (my italics). I am not suggesting that we should seek one 'correct' account of the genealogy of new materialisms but, rather, that we should be cautious about understanding new materialist theorising in terms of objections or challenges to other modes of thought. Barad does not assert an *opposition* of materiality and signification but seeks to *rethink their relationships*. As Donna Haraway

(1989, p. 111) insists, ‘No one can constitute meanings by wishing them into existence; discourse is a material practice’. Barad’s agential realism explicitly avoids reinscribing a material/discursive dichotomy. In her account, the material and the discursive are mutually implicated in a process she calls *intra-action*:

Discursive practices and material phenomena do not stand in a relationship of externality to each other; rather, the material and the discursive are mutually implicated in the dynamics of intra-activity. The relationship between the material and the discursive is one of mutual entailment. Neither discursive practices nor material phenomena are ontologically or epistemologically prior. Neither can be explained in terms of the other. Neither is reducible to the other. Neither has privileged status in determining the other. Neither is articulated or articulable in the absence of the other; matter and meaning are mutually articulated (Barad, 1997, p. 152).

Recent demonstrations of the generativity of Barad’s concept of intra-action for outdoor and/or environmental education research include Pauliina Rautio’s (2013, 2014) studies of child–matter intra-action in Finland, in which she probed the significance of ‘the things – rubberbands, pencils, toy figurines, broken pieces of plastic, stones, toy cars, glitter or dust, to name but a fraction of objects’ (Rautio, 2014, p. 7) with which children autonomously intra-acted. Rautio (2013, p.2) provides a succinct description of the distinction between conventional Anglophone understandings of *interaction* and Barad’s *intra-action*:

In interaction independent entities are viewed as taking turns in affecting each other, these entities are taken to each have an independent existence. In intraaction, interdependent entities are taken to co-emerge through simultaneous activity to come into being as certain kind of entity because of their encounter.

Karen Malone (2016, pp. 47-48) deploys the concept of intra-action very effectively in her research with children and dogs in La Paz, Bolivia:

The appeal of adopting the conceptual tool of ‘intra-action’ was in the ability it afforded me to view intra-species encounters as vibrant, in which the human and nonhuman objects were actors shaping and being shaped by these vibrant encounters.

In a somewhat similar vein, Debbie Sonu and Nathan Snaza (2015, p. 258) draw from their field experiences in New York City elementary schools to demonstrate ‘how curricular engagements with nature and the environment are persistently caught within humanist traditions’. They use new materialist ontologies to suggest how hybrid relations – that is, Barad’s ‘intra-actions’ – among humans, nonhumans, and matter facilitates ‘a recognition that humans are not the only significant actors in the world and thus enables a more distributive agency’ (Sonu & Snaza, 2015, p. 267):

While current practices are narrowly focused on the strict control of curriculum and pedagogy, perhaps the issue is not about finding more ways to establish predetermined ends in teaching, but more about relational forms of educational agency emerging among children, teachers, and the array of non-human actants in the moment that education presents itself...Pedagogies inspired by posthumanist and new materialist ontologies are situational encounters made up of entanglements and interweavings, conjoint actions and political ecologies, entanglements that are alive, vibrant, and powerful (Sonu & Snaza, 2015, pp. 271...274).

Other recent examples of new materialisms informing outdoor and environmental education include Jamie McPhie and David Clarke's (2015) exploration of practice in these fields through what they call 'an immanent take on the material turn' and these same authors' (Clarke & McPhie, 2015) considerations of what such modes of thought might produce in terms of conceptualising *Learning for Sustainability*, a recent development in Scottish educational policy.

In a recent essay on ecofeminism and climate change, Greta Gaard (2015, p. 30) uses 'intra-action' to expand the concept of 'intersectionality' (see, e.g., Crenshaw, 1991) beyond humanistic assumptions:

Feminist scholars have invoked the concept of intersectionality in order to describe the 'intra-actions' of race, class, gender, sexuality, ethnicity, age, ability and other forms of human difference, using this analysis to develop more nuanced understandings of power, privilege, and oppression. But fewer scholars have critiqued the humanism of intersectionality, or proposed examining the exclusions of species and ecosystems from intersectional identities.

Another feminist scholar, Sarah Kember (2015) examines debates about the intentionality and agency of material objects without assuming any inherent separation between materials and human subjectivity. Kember problematises gendered access to the objects, environments and smart materials that she identifies collectively as 'imedia', and interrogates the ways in which these commodities function as agents of subjection (especially of women).

Enacting postparadigmatic materialism: research as assemblage

I focus much of my discussion in the previous section on Barad's work, because any citation analysis of the literature around 'new materialism' and 'new ontology' demonstrates that her influence is incontestable, but it is also important to emphasise that although her influence is incontestable, many other scholars have contributed to shaping these modes of thought, and some aspects of Barad's scholarship remain open to critique.³ Thus, in this section, I will outline some of other significant theoretical contributions, with particular reference to Deleuze and Guattari's concept of a *machinic assemblage*.

Barad participates in an expanding movement of scholars working with what Patricia Clough (2009) calls 'the new empiricisms' and others (such as Coole & Frost, 2010; Dolphijn & van der Tuin, 2012) refer to as 'new materialisms'. In St. Pierre, Jackson and Mazzei's (2016, p. 99) words, these scholars are responding to 'an ethical imperative to rethink the nature of being to refuse the devastating dividing practices of the dogmatic Cartesian image of thought', that is, to critique the foundational assumptions of Western thought 'that enable binary oppositions such as Same/Other, human/nonhuman, mind/matter, culture/nature, conscious/unconscious, transcendence/immanence, idealism/materialism, and so on':

A special focus on the ontological grounds on which those distinctions continue to be made is front and center in this work, as are other age-old distinctions such as those between philosophy and science, those philosophy has made between epistemology and ontology, and those epistemology has made between rationalism and empiricism. (St. Pierre, Jackson and Mazzei, 2016, p. 99)

St. Pierre, Jackson and Mazzei's (2016) essay, which introduces a special issue of *Cultural Studies ↔ Critical Methodologies* on new empiricisms and new materialisms, provides a brief explanation of how matter is understood as animated and agential in the new materialism,

which some feminist science scholars, including Stacy Alaimo and Susan Hekman (2008) refer to as *material feminisms*. In another article in this issue, St. Pierre (2016) describes several empiricisms, distinguishing the ‘new’ empiricisms from two other empiricisms commonly used in social inquiry, namely, logical and phenomenological empiricism, as well as explaining how Deleuze’s (1994) and Deleuze & Guattari’s (1994) ‘transcendental empiricism’ is deployed in much new empirical inquiry. Wisely, however, these authors make no attempt to define or summarise what the new materialisms and new empiricisms *are* – because they are concepts in process of formation and they are not one thing although, clearly, empiricism and materialism go hand in hand:

The empirical and the material are so imbricated they must change together, and with those changes comes a rethinking of ontology, which considers the nature of being and the basic categories of existence (e.g., subject/object, essence/appearance, substance/quality, identity/difference) as well as the nature of *human* being. As we rethink matter, we must rethink the empirical (about knowledge) and ontology (about being), and the classical division between the two begins to break down. (St. Pierre, Jackson & Mazzei, 2016, p. 99, italics in original)

The emphasis on the word ‘human’ in the above passage implies a problematisation of the concept, and discussions about new materialisms and new empiricisms frequently invoke consideration of the *more-than-human* (see, for example, Anderson & Perrin, 2015; Pyyhtinen, 2016; Whatmore, 2006) and the *posthuman* (see, for example, Weaver, 2010; Braidotti, 2013; Snaza and Weaver, 2015; Taylor and Hughes 2016), to which I will return in the penultimate section of this essay.

As foreshadowed above, Deleuze’s (and Deleuze & Guattari’s) work is regularly presented alongside that of theorists who are directly associated with the new materialisms and new empiricisms. This is certainly the case for all of the authors I have so far cited in this context, although Hein (2016, p. 132) argues that despite Barad and Deleuze using some of the same terms, the meanings that they assign to each of these terms differs, with the result that their ontologies/philosophies also have different implications for inquiry.

Nick Fox and Pam Alldred (2015b, p. 399) provide a very useful and practical discussion of research design and methods in new materialist social inquiry, emphasising that new materialism ‘de-privileges human agency, focusing instead upon how assemblages of the animate and inanimate together produce the world’. They take the concept of assemblages from Deleuze and Guattari (1987, p. 20) who assert that ‘all we know are assemblages. And the only assemblages are machinic assemblages of desire and collective assemblages of enunciation’. Their concept of machinic assemblages, rather than organisms or mechanisms, subverts the idea that wholes pre-exist connections. As Deleuze explains, ‘Machine, machinism, “machinic”: this does not mean either mechanical or organic. Mechanics is a system of closer and closer connections between dependent terms’ (Deleuze & Parnet, 1987, p. 104). Claire Colebrook (2002, p. 56) offers a useful example of the sense in which Deleuze and Guattari use ‘machine’:

Think of a bicycle, which obviously has no ‘end’ or intention. It only works when it is connected with another ‘machine’ such as the human body; and the production of these two machines can only be achieved through connection. The human body becomes a cyclist in connecting with the machine; the cycle becomes a vehicle. But we could imagine different connections producing different machines. The cycle becomes an art object when placed in a gallery; the human body becomes an ‘artist’ when connected with a paintbrush.

Central to Fox and Alldred's (2015, p. 399) exploration of social inquiry methodology and methods is 'the materialist notion of a "research-assemblage" comprising researcher, data, methods and contexts'. They initially use this understanding to explore the micropolitics of the research process, and then, together with a review of thirty recent empirical studies, to establish a framework for materialist social inquiry methodology and methods (see also Fox, 2016; Fox & Alldred, 2015a).

Challenging anthropocentrism

In a wide-ranging essay, Hannes Bergthaller et al. (2014, p. 261) seek to 'map the common ground on which close interdisciplinary cooperation will be possible' in the environmental humanities, with particular reference to the fields of ecocriticism and environmental history. These authors emphasise that

'the environment' should not be addressed as exclusively material. It is not simply something that surrounds human societies, but is also the product of social practices of 'environing' – of the multiple processes through which human beings (and other species) modify their surroundings as they make their living from and in the natural world, and of the symbolic transformations which configure 'the environment' as a space for human action (Bergthaller et al., 2014, p. 267)

Bergthaller et al. (2014, p. 271) also see 'the emergence of new materialist and material feminist approaches to bodies, things, animality, and agency' as a 'development that opens up new avenues for interdisciplinary research, and which can profitably be linked with theories of environmental justice'. By way of example, they draw particular attention to Alaimo and Hekman's (2008, p. 9) proposition that 'thinking through the co-constitutive materiality of human corporeality and nonhuman natures offers possibilities for transforming environmentalism itself'. Alaimo and Hekman's (2008, p. 9) elaboration of this proposition is worth quoting in full:

Environmental justice movements, for example, locate 'the environment' not in some distant place, but within homes, schools, workplaces, and neighborhoods. These movements reveal that lower-class peoples, indigenous peoples, and people of color carry a disproportionate toxic load. Tracing the traffic in toxins involves scientific/economic/political/ethical analyses of realms and interest groups heretofore imagined separately, for example, those of health, medicine, occupational safety, disability rights, and environmental justice, as well as 'traditional' environmentalisms devoted to the welfare of wild creatures. The same material substance, in this case, a particular toxin such as mercury or dioxin, may affect the workers who produce it, the neighborhood in which it is produced, the domesticated and wild animals that ingest it, and the humans who ingest the animals who have ingested it. Beginning with material substances rather than already constituted social groups may, in fact, allow for the formation of unexpected political coalitions and alliances.

Building on this suggestion, Bergthaller et al. (2014, p. 271) see 'focusing on singular material substances, instead of adopting the perspective of particular social groups, as a way to reach a more comprehensive understanding of social and environmental injustices. This radical challenge to anthropocentrism has methodological implications for the environmental humanities'. Taking their cue from scholars such as those represented in Carl Knappett and Lambros Malafouris's (2008) *Material Agency*, they assert that 'new materialists enrich the

environmental justice framework by questioning the tendency to gloss over the agency of matter in our everyday lives' (Bergthaller et al., 2014, p. 271). They continue:

While the ethical and political consequences of acknowledging the agency of things (Styrofoam cups, birch trees, coal dust) remain to be spelled out (and are unlikely to be comforting), such a view clearly posits new forms of analysis and enables new ways of narrating environmental history, especially the history of environmental injustice... Any attempt to combine environmental history and ecocriticism along these lines must deal with the central question of the place of texts and the function of textual interpretations (Bergthaller et al., 2014, p. 271-2).

Thus, these authors affirm the continued relevance of poststructuralist analysis of discourses and texts to new materialist research approaches. Texts are entangled with and address the material processes by which societies conceptualize and manage their environments, and their structuring assumptions must therefore be revealed and explained. Bergthaller et al. (2014, p. 272) conclude that

the environmental humanities must be relentlessly and deftly historicist: they always must bear in mind that texts are historically produced and can be historically productive, too. Texts reiterate established protocols of environing, but in doing so they also expose them to our scrutiny and make it possible for us to imagine alternatives.

From a posthumanist/materialist standpoint I am curious to explore (and seek to resolve) an apparent contradiction concerning anthropocentrism in the literatures of outdoor and environmental education research (see also N. Gough, 2015b; A Gough & N. Gough, 2016a). On the one hand, many outdoor and environmental activists, philosophers, and educators view anthropocentrism as an undesirable ethical position and valorise conceptual alternatives signified by terms such as 'biocentrism' and/or 'ecocentrism'. On the other hand, many reports of outdoor and environmental education research privilege an anthropocentric gaze, which assumes autonomous human subjects as starting points for knowledge production and the focus of attention for data production and analysis. This is particularly noticeable in US literature where, for example, as Joy Palmer (1998) concludes, the majority of research reports published in *The Journal of Environmental Education* in the 1970s and 1980s were concerned with the identification, prediction, and control of variables that were believed to be the critical cognitive and affective determinants of responsible environmental behaviour. Paul Hart & Kathleen Nolan's (1999, p. 6) extensive review of environmental education research from 1992 to 1999 confirms that 'causal-comparative experimental studies which attempt to connect environmental knowledge, attitudes and behaviours continued to dominate quantitative reports on research through the 1990s'. Although environmental education research in Australia, Canada, Europe and South Africa (and, more recently, the USA) has deployed a variety of nonpositivist approaches, these have chiefly involved interpretive and socially critical methodologies in which human subjects remain the key focus of attention. With some noteworthy exceptions, relatively few examples of environmental education research enact the feminist and poststructuralist methodologies that, for at least two decades in the wider discipline of education, have contested humanistic assumptions and theorised learners as situational, contextual and discursively inscribed.

Holding the idea of 'human' under erasure, I suggest that challenging *hierarchical anthropocentrism* (i.e. challenging the assumption of human superiority) does not prevent us from acknowledging an *irreducible anthropocentrism*, that is, accepting that we necessarily

experience the world with species-specific biophysical limitations *and possibilities*. However, we must also consider how an understanding of irreducible anthropocentrism might be changed by accepting that we increasingly experience the world as *posthumans*, with perhaps (eventually) *fewer* species-specific biophysical limitations and with further possibilities provided by biophysical extensions, enhancements and assemblages. I suggest that conceiving ourselves and the subjects/objects of our inquiries in terms of Deleuze and Guattari's machinic assemblages, and recognizing that our material selves are different from other environmental materials with which we interact, might dispose us towards understanding posthuman/place relations as mutually constitutive. That is, posthuman/place relations are not about individual subjects autonomously forming and developing relations with the world but, rather, about realising that these relations always already exist, and might be as much influenced by the behaviour of other materials in the places we inhabit as they are by our intentional or unintentional actions. Such considerations support what Karin Hultman and Hillevi Lenz Taguchi (2010) call a *relational materialist* methodology which, in the context of place-based outdoor and environmental education research, would involve creating concepts for understanding learners as emergent in relational fields in which non-human materials are inevitably at play in constituting their becomings. This methodological approach is consistent with the feminist poststructuralist materialism exemplified by Haraway (1991, 2007) and Barad (2003, 2011), with particular reference to the latter's elaboration of a materialist, naturalist, and posthumanist performativity. This approach is further inflected by Deleuze and Guattari's (1987) description of the Earth as 'an immense Abstract Machine' (p. 254), in which (post)humans are always in composition with other materials, and by what Katherine Hayles (2012, p. 24) calls *technogenesis*, that is, 'the idea that human and technics have coevolved together'.

Hayles (2012) focuses in particular on digital technologies and argues that a human individual's interactions with digital media are not only cognitive but also 'have bodily effects on the physical level' (p. 15). For Hayles, embodiment 'takes the form of extended cognition, in which human agency and thought are enmeshed within larger networks that extend beyond the desktop computer into the environment' (p. 15). In Hayles' view 'all cognition is embodied, which is to say that for humans, it exists throughout the body, not only in the neocortex. Moreover, it extends beyond the body's boundaries in ways that challenge our ability to say where or even if cognitive networks end' (p. 31). Elsewhere, Hayles (2005, pp. 131-132) argues that the complex interactions (or intra-actions in Barad's terms) shaping our ideas of 'human nature' include material culture:

Anthropologists have long recognized that the construction of artifacts and living spaces materially affects human evolution. Changes in the human skeleton that permitted upright walking co-evolved, anthropologists believe, with the ability to transport objects, which in turn led to the development of technology. We need not refer to something as contemporary and exotic as genetic engineering to realize that for millennia, a two-cycle phenomenon has been at work: humans create objects, which in turn help to shape humans. This ancient evolutionary process has taken a new turn with the invention of intelligent machines.

Hayles (2012, p. 68) introduces the concept of technogenesis in a section titled 'How we read: close, hyper, machine' in which she distinguishes between close reading, requiring deep attention, that characterises much academic research, and fast or hyper reading that relies on sporadic sampling. Hayles argues that these different types of cognition are embodied 'conscious, unconscious, and nonconscious processes' (p. 68) and cites recent neurological studies that demonstrate measurable differences between the brain functions of someone

close-reading and performing a Google search (pp.76-8). The embodied neural plasticity that links digital media with various types of reading and attention, as demonstrated by neurological and cognitive research, exemplifies for Hayles a mechanism of technogenesis whereby ‘epigenetic changes in human biology can be accelerated by changes in the environment that make them even more adaptive, which leads to further epigenetic changes’ (p. 24). Although the idea of an interrelationship between human evolution and human-produced technologies is not new, Hayles’ concept of a technogenesis driven by digital media is more complex than neo-Darwinian understandings that view the environment as largely static, with organisms changing to accommodate to it across lengthy periods of time. In Hayles’ view, both humans and digital technologies change across much shorter time scales due to neural plasticity at various levels, including unconscious perceptions.

Hayles (2012) offers persuasive evidence that refutes the claims of anti-digital media journalists such as Nicholas Carr (2010) that hyperlinked reading causes the degradation of comprehension and she argues that this ‘condescending view of media... forecloses an important resource for contemporary self-fashioning, for using [neural] plasticity both to subvert and redirect the dominant order’ (p. 97). She adds:

It is far too simplistic to say that hyper attention represents a cognitive deficit or a decline in cognitive ability among young people... On the contrary, hyper attention can be seen as a positive adaptation that makes young people better suited to live in information-intensive environments (Hayles, 2012, p. 112).

Hayles (2012) prompts me to consider the implications for place-based outdoor and environmental education research of her accounts of how we read and think. The concepts of close and hyper reading do not only apply to print and electronic media but also to our ‘reading’ of landscapes and activities located in them. Walking in a rainforest can be as ‘information-intensive’ as searching the Internet but I know of no studies of the brain functions of people reading and attending to such environments in different ways that might be the equivalents of the neurological and cognitive studies of close and hyper reading. I can envisage considerable conceptual, methodological and technical difficulties in conducting such research in outdoor environments, but I contend that the underlying question of how a propensity for hyper reading affects environmental interpretation is nevertheless worthy of exploration.

Afterword

I share Susanne Kappeler’s (1986, p. 212) antipathy to the conventional ways of concluding an academic essay: ‘I do not really wish to conclude and sum up, rounding off the argument so as to dump it in a nutshell on the reader. A lot more could be said about any of the topics I have touched upon’.

I could certainly have written much more about the potential generativity of new materialist theorising for performing research in outdoor and environmental education but, given the recency of much of the literature on this topic, it is much too soon to be making definitive, conclusive or prescriptive recommendations for practice. As Brian Massumi (2010, p. 3) writes: ‘philosophy cannot be content to reflect, pronouncing upon the world from a disengaged posture of explanatory description or judgmental prescription. To contribute to change is to herald the new. The new, by definition, cannot be described, having yet to arrive’. I am more confident that my essay draws attention to some practices we should seek to avoid, such as adhering to the strictures of exhausted paradigms that describe inquiry in advance in order to control it, and regressing to old habits of thought, such as reinscribing dichotomies between, say, material phenomena and the discursive practices we use to

represent them. Imagining ourselves in a postparadigmatic diaspora means that we cannot navigate the complex intellectual terrain of research by reference to the old landmarks of positivist, interpretive and critical inquiry. Rather, it gives us the freedom – to borrow John Rajchman's (2000, p. 17) words – to 'look for the conditions under which something new, as yet unthought, arises'.

Notes

- ¹ The theme of the special issue to which Payne provides both the introduction and conclusion is 'The Politics of Policy in Education for Sustainable Development'.
- ² It is not easy to discern what Mertens (2005, p. 8) understands by 'postpositivism', because her 'list of labels commonly associated with different paradigms' exemplifies postpositivism with the labels 'Experimental, Quasi-experimental, Correlational, Causal comparative, Quantitative [and] Randomized control trials', all of which are approaches to inquiry that identify 'facts' with measurable phenomena and implicitly equate with the Cartesian version of objective knowledge production that came to be called positivism.
- ³ Much of Barad's (1997) *Meeting the Universe Halfway* reflects her training as a high-energy theoretical physicist who now is a professor of feminist studies, philosophy, and history of consciousness. She predicates many of her arguments for 'how and why we must understand in an integral way the roles of human and nonhuman, material and discursive, and natural and cultural factors in scientific and other practices' (Barad, 1997, p. 25) on her interpretation of Neils Bohr's and Werner Heisenberg's quantum mechanics but, as Silvan Schweber (2008, p. 881) points out, she almost completely overlooks the contributions of Wolfgang Pauli (he is mentioned in a footnote) and his extensive correspondence with Bohr and Heisenberg, as well as more recent scholarship on the subject. Schweber (who is also an eminent professor of physics and the history of ideas) disagrees with 'Barad's assessment of the failure of representational approaches in fundamental physics... advances at the nuclear and subnuclear levels were due to the possibility of a confluence between ontology and representation'. I was also astonished by Barad's (2007, p. 85) assertion that quantum mechanics is 'the correct theory of nature that applies to all scales'. This ignores Sandra Harding's (1986, p. 193) call to resist 'the longing for "one true story" that has been the psychic motor for [modern] Western science'. Also, as Schweber (2008, p. 881) points out, although quantum mechanics applies to a wide range of length scales, it is not a 'final theory' or a 'theory of everything'; the fact that it cannot (to date) incorporate gravitational phenomena is one indication of this.

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References

(NB. In regard to the use of full names in this reference list, I depart from the *Publication Manual of the American Psychological Association* to facilitate reading the gender politics of my sources. I also believe that it is discourteous to authors to arbitrarily truncate the ways in which they prefer to identify themselves.)

- Alaimo, Stacy, & Hekman, Susan. (2008). Introduction: emerging models of materiality in feminist theory. In Stacy Alaimo & Susan Hekman (Eds.), *Material Feminisms* (pp. 1-19). Bloomington: Indiana University Press.
- Anderson, Kay, & Perrin, Colin. (2015). New materialism and the stuff of humanism. *Australian Humanities Review* (58), 1-16.
- Atkinson, Paul, Delamont, Sara, & Hammersley, Martin. (1988). Qualitative research traditions: A British response to Jacob. *Review of Educational Research*, 58(2), 231-250.
- Barad, Karen. (2003). Posthumanist performativity: toward an understanding of how matter comes to matter. *Signs: Journal of Women in Culture and Society*, 28(3), 801-831.

- Barad, Karen. (2007). *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham & London: Duke University Press.
- Barad, Karen. (2011). Nature's queer performativity. *Qui Parle*, 19(2), 121-158.
- Barrett, M. J. (2005). Making (some) sense of feminist poststructuralism in environmental education research and practice. *Canadian Journal of Environmental Education*, 10, 79-93.
- Barrett, M. J. (2006). Education for the environment: action competence, becoming, and story. *Environmental Education Research*, 12(3-4), 503-511.
- Barron, Deirdre. (1995). Gendering environmental education reform: identifying the constitutive power of environmental discourses. *Australian Journal of Environmental Education*, 11, 107-120.
- Bergthaller, Hannes, Emmett, Rob, Johns-Putra, Adeline, Kneitz, Agnes, Lidström, Susanna, McCorristine, Shane, Pérez Ramos, Isabel, Phillips, Dana, Rigby, Kate & Robin, Libby (2014). Mapping common ground: ecocriticism, environmental history, and the environmental humanities. *Environmental Humanities*, 5(1), 261-276.
- Braidotti, Rosi. (2013). *The Posthuman*. Cambridge MA: Polity Press.
- Caputo, John. (1987). *Radical Hermeneutics: Repetition, Deconstruction, and the Hermeneutic Project*. Bloomington: Indiana University Press.
- Caputo, John. (2000). *More Radical Hermeneutics: On Not Knowing Who We Are*. Bloomington: Indiana University Press.
- Carr, Nicholas G. (2010). *The Shallows: What the Internet Is Doing to Our Brains*. New York: W. W. Norton & Company.
- Cheney, Jim. (1989). Postmodern environmental ethics: ethics as bioregional narrative. *Environmental Ethics*, 11(2), 117-134.
- Cherryholmes, Cleo. (1988). *Power and Criticism: Poststructural Investigations in Education*. New York: Teachers College Press.
- Clarke, David A. G., & McPhie, Jamie. (2015). From places to paths: *Learning for Sustainability*, teacher education and a philosophy of becoming. *Environmental Education Research*, doi 10.1080/13504622.2015.1057554 (published online 3 July, 2015)
- Clough, Patricia Ticineto (2009). The new empiricism: affect and sociological method. *European Journal of Social Theory*, 12(1), 43-61.
- Colebrook, Claire. (2002). *Gilles Deleuze*. London: Routledge.
- Connolly, William E. (Ed.). (2013). *The Fragility of Things: Self-Organizing Processes, Neoliberal Fantasies, and Democratic Activism*. Durham, NC: Duke University Press.
- Coole, Diana, & Frost, Samantha (Eds.). (2010). *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.
- Crenshaw, Kimberlé. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241-1299.
- Deleuze, Gilles. (1994). *Difference and Repetition* (Paul Patton, Trans.). New York: Columbia University Press.
- Deleuze, Gilles, & Guattari, Félix. (1987). *A Thousand Plateaus: Capitalism and Schizophrenia* (Brian Massumi, Trans.). Minneapolis: University of Minnesota Press.
- Deleuze, Gilles, & Guattari, Félix. (1994). *What is Philosophy?* (Graham Burchell & Hugh Tomlinson, Trans.). London: Verso.
- Deleuze, Gilles, & Parnet, Claire. (1987). *Dialogues* (Hugh Tomlinson & Barbara Habberjam, Trans.). New York: Columbia University Press.
- Derrida, Jacques. (1976). *Of Grammatology* (Gayatri Chakravorty Spivak, Trans.). Baltimore: The Johns Hopkins University Press.
- Dolphijn, Rick, & van der Tuin, Iris. (2012). *New Materialisms: Interviews and Cartographies*. Ann Arbor, MI: Open Humanities Press.

- Ferreira, Jo-Anne. (1999). Learning to govern oneself: environmental education pedagogy and the formation of an environmental subject. *Australian Journal of Environmental Education*, 15, 31-35.
- Fox, Nick J. (2016). Health sociology from post-structuralism to the new materialisms. *Health: An Interdisciplinary Journal for the Social Study of Health, Illness and Medicine*, 20(1), 62-74.
- Fox, Nick J., & Alldred, Pam. (2015a). Inside the research-assemblage: new materialism and the micropolitics of social inquiry. *Sociological Research Online*, 20(2). doi:10.5153/sro.3578 <http://www.socresonline.org.uk/20/2/6.html>
- Fox, Nick J., & Alldred, Pam. (2015b). New materialist social inquiry: designs, methods and the research-assemblage. *International Journal of Social Research Methodology*, 18(4), 399-414.
- Gaard, Greta. (2015). Ecofeminism and climate change. *Women's Studies International Forum*, 49(2), 20-33.
- Gage, Nathaniel L. (1989). The paradigm wars and their aftermath: a 'historical' sketch of research on teaching since 1989. *Educational Researcher*, 18(7), 4-10.
- Gough, Annette. (1994). *Fathoming the fathers in environmental education: a feminist poststructuralist analysis*. (PhD thesis), Deakin University.
- Gough, Annette. (1997). Founders of environmental education: narratives of the Australian EE movement. *Environmental Education Research*, 3(1).
- Gough, Annette. (1999a). The power and the promise of feminist research in environmental education. *Southern African Journal of Environmental Education*, 19, 29-39.
- Gough, Annette. (1999b). Recognising women in environmental education pedagogy and research: toward an ecofeminist poststructuralist perspective. *Environmental Education Research*, 5(2), 143-161.
- Gough, Annette, & Gough, Noel. (2016a). Beyond cyborg subjectivities: becoming-posthumanist educational researchers. *Educational Philosophy and Theory*. <http://dx.doi.org/10.1080/00131857.2016.1174099>
- Gough, Annette, & Gough, Noel. (2016b). The denaturation of environmental education: exploring the role of ecotechnologies. *Australian Journal of Environmental Education*, 32(1), 30-41.
- Gough, Annette, & Whitehouse, Hilary. (2003). The 'nature' of environmental education research from a feminist poststructuralist standpoint. *Canadian Journal of Environmental Education*, 8, 31-43.
- Gough, Noel. (1987). Learning with environments: towards an ecological paradigm for education. In Ian Robottom (Ed.), *Environmental Education: Practice and Possibility* (pp. 49-67). Geelong: Deakin University.
- Gough, Noel. (1991). Narrative and nature: unsustainable fictions in environmental education. *Australian Journal of Environmental Education*, 7, 31-42.
- Gough, Noel. (1993). Environmental education, narrative complexity and postmodern science/fiction. *International Journal of Science Education*, 15(5), 607-625.
- Gough, Noel. (1994). Playing at catastrophe: ecopolitical education after poststructuralism. *Educational Theory*, 44(2), 189-210.
- Gough, Noel. (1999). Rethinking the subject: (de)constructing human agency in environmental education research. *Environmental Education Research*, 5(1), 35-48.
- Gough, Noel. (2000). Interrogating silence: environmental education research as postcolonialist textwork. *Australian Journal of Environmental Education*, 15/16, 113-120.
- Gough, Noel. (2006). Sustainable development in learning, leadership and the law: a review essay. *Australian Journal of Environmental Education*, 22(1), 115-121.

- Gough, Noel. (2009). Becoming transnational: rhizosemiosis, complicated conversation, and curriculum inquiry. In Marcia McKenzie, Heesoon Bai, Paul Hart & Bob Jickling (Eds.), *Fields of Green: Restorying Culture, Environment, and Education* (pp. 67-83). Cresskill NJ: Hampton Press.
- Gough, Noel. (2015a). Rewording the world: narrative and nature after poststructuralism. In Margaret Robertson, Ruth Lawrence & Greg Heath (Eds.), *Experiencing the Outdoors: Enhancing Strategies for Wellbeing* (pp. 233-244). Rotterdam: Sense Publishers.
- Gough, Noel. (2015b). Undoing anthropocentrism in educational inquiry: a phildickian space odyssey? In Nathan J. Snaza & John A. Weaver (Eds.), *Posthumanism and Educational Research* (pp. 151-166). New York: Routledge.
- Gough, Noel, & Price, Leigh. (2004). Rewording the world: poststructuralism, deconstruction and the 'real' in environmental education research. *Southern African Journal of Environmental Education*, 21, 23-36.
- Gough, Noel, & Sellers, Warren. (2004). *Re/de/signing the world: poststructuralism, deconstruction and 'reality' in outdoor environmental education research*. Paper presented at the International Outdoor Education Research Conference, *Connections and Disconnections: Examining the reality and rhetoric*, La Trobe University Bendigo, Victoria, Australia.
http://www.latrobe.edu.au/education/downloads/2004_conference_gough2.pdf
- Haraway, Donna J. (1989). *Primate Visions: Gender, Race, and Nature in the World of Modern Science*. New York: Routledge.
- Haraway, Donna J. (1991). *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge.
- Haraway, Donna J. (2007). *When Species Meet*. Minneapolis: University of Minnesota Press.
- Harding, Sandra. (1986). *The Science Question in Feminism*. Ithaca NY: Cornell University Press.
- Hart, Paul, & Nolan, Kathleen. (1999). A critical analysis of research in environmental education. *Studies in Science Education*, 34(1), 1-69.
- Hayles, N. Katherine. (2005). Computing the Human. *Theory, Culture & Society*, 22(1), 131-151.
- Hayles, N. Katherine. (2012). *How We Think: Digital Media and Contemporary Technogenesis*. Chicago: University of Chicago Press.
- Hein, Serge F. (2016). The new materialism in qualitative inquiry: how compatible are the philosophies of Barad and Deleuze? *Cultural Studies ↔ Critical Methodologies*, 16(2), 132-140.
- Hultman, Karin, & Lenz Taguchi, Hillevi. (2010). Challenging anthropocentric analysis of visual data: a relational materialist methodological approach to educational research. *International Journal of Qualitative Studies in Education*, 23(5), 525 - 542.
- Jickling, Bob. (2016). Losing traction and the art of slip-sliding away: Or, getting over education for sustainable development. *The Journal of Environmental Education*, 47(2), 128-138.
- Johns-Putra, Adeline. (2013). Environmental care ethics: notes toward a new materialist critique. *symplokē: a journal for the intermingling of theoretical~cultural~literary scholarship*, 21(1-2), 125-135.
- Kappeler, Susanne. (1986). *The Pornography of Representation*. Cambridge MA: Polity Press.
- Kember, Sarah. (2015). *iMedia: The Gendering of Objects, Environments and Smart Materials*. London: Palgrave Macmillan.
- Knappett, Carl, & Malafouris, Lambros (Eds.). (2008). *Material Agency: Towards a Non-Anthropocentric Approach*. New York: Springer.

- Kuhn, Thomas S. (1962). *The Structure of Scientific Revolutions* (1st ed.). Chicago: University of Chicago Press.
- Latour, Bruno. (2013). *An Inquiry into Modes of Existence: An Anthropology of the Moderns* (Catherine Porter, Trans.). Cambridge MA: Harvard University Press.
- Malone, Karen. (2016). Reconsidering children's encounters with nature and place using posthumanism. *Australian Journal of Environmental Education*, 32(1), 42-56.
- Marcus, George E., & Fischer, Michael M.J. (1986). *Anthropology as Cultural Critique: An Experimental Moment in the Human Sciences*. Chicago & London: University of Chicago Press.
- Massey, Doreen. (2003). Imagining the field. In Michael Pryke, Gillian Rose & Sarah Whatmore (Eds.), *Using Social Theory: Thinking Through Research* (pp. 71-88). Thousand Oaks CA: Sage Publications Inc.
- Massumi, Brian. (2010). What concepts do: Preface to the Chinese translation of *A Thousand Plateaus*. *Deleuze Studies*, 4(1), 1-15.
- McKenzie, Marcia. (2005). The 'post-post period' and environmental education research. *Environmental Education Research*, 11(4), 401-412.
- McPhie, Jamie, & Clarke, David A. G. (2015). A walk in the park: considering practice for outdoor environmental education through an immanent take on the material turn. *The Journal of Environmental Education*, 46(4), 230-250.
- Merchant, Carolyn. (2003). *Reinventing Eden: The Fate of Nature in Western Culture*. New York: Routledge.
- Mertens, Donna M. (2005). *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed Methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- O'Donoghue, Rob, & Lotz-Sisitka, Heila. (2005). Towards a better grasp of what matters in view of 'the posts'. *Environmental Education Research*, 11(4), 445-454.
- Palmer, Joy A. (1998). *Environmental Education in the 21st Century: Theory, Practice, Progress and Promise*. London and New York: Routledge.
- Payne, Phillip G. (2016). What next? Post-critical materialisms in environmental education. *The Journal of Environmental Education*, 47(2), 169-178.
- Pyyhtinen, Olli. (2016). *More-than-Human Sociology: A New Sociological Imagination*: Palgrave Macmillan UK.
- Rajchman, John. (2000). *The Deleuze Connections*. Cambridge MA: MIT Press.
- Rautio, Pauliina. (2013). Children who carry stones in their pockets: on autotelic material practices in everyday life. *Children's Geographies*, 11(4), 394-408.
- Rautio, Pauliina. (2014). Mingling and imitating in producing spaces for knowing and being: Insights from a Finnish study of child-matter intra-action. *Childhood*, 21(4), 461-474.
- Rorty, Richard. (1979). *Philosophy and the Mirror of Nature*. Princeton NJ: Princeton University Press.
- Rorty, Richard. (1989). *Contingency, Irony, and Solidarity*. Cambridge MA: Cambridge University Press.
- Russell, Constance L. (2005). 'Whoever does not write is written': the role of 'nature' in post-post approaches to environmental education research. *Environmental Education Research*, 11(4), 433-443.
- Salleh, Ariel. (1997). *Ecofeminism as Politics: Nature, Marx and the Postmodern*. London and New York: Zed Books.
- Schmitz, Sigrid. (2015). Collaborative enactments in teaching with feminist materialism. In Peta Hinton & Pat Treusch (Eds.), *Teaching With Feminist Materialisms* (pp. 67-82). Utrecht: ATGENDER. The European Association for Gender Research, Education and Documentation.

- Schweber, Silvan .S. (2008). Karen Barad (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* [book review]. *Isis. A Journal of the History of Science Society*, 99(4), 879-882.
- Scott, William A. H., & Gough, Stephen R. (2004). *Sustainable Development and Learning: Framing the Issues*. London and New York: RoutledgeFalmer.
- Shaviro, Steven. (1997). *Doom Patrols: A Theoretical Fiction About Postmodernism*. New York and London: Serpent's Tail.
- Shaviro, Steven. (2014). *The Universe of Things: On Speculative Realism*. Minneapolis: University of Minnesota Press.
- Snaza, Nathan J., & Weaver, John A. (Eds.). (2015). *Posthumanism and Educational Research*. New York: Routledge.
- Sonu, Debbie, & Snaza, Nathan. (2015). The fragility of ecological pedagogy: elementary social studies standards and possibilities of new materialism. *Journal of Curriculum and Pedagogy*, 12(3), 258-277.
- Spretnak, Charlene. (1999). *The Resurgence of the Real: Body, Nature, and Place in a Hypermodern World*. New York: Routledge.
- St. Pierre, Elizabeth A. (2016). The empirical and the new empiricisms. *Cultural Studies ↔ Critical Methodologies*, 16(2), 111-124.
- St. Pierre, Elizabeth A., Jackson, Alecia Y., & Mazzei, Lisa A. (2016). New empiricisms and new materialisms: conditions for new inquiry. *Cultural Studies ↔ Critical Methodologies*, 16(2), 99-110.
- Stables, Andrew. (1996). Reading the environment as text: literary theory and environmental education. *Environmental Education Research*, 2(2), 189-195.
- Stevenson, Robert B., & Evans, Neus (Snowy). (2011). The distinctive characteristics of environmental education research in Australia: an historical and comparative analysis. *Australian Journal of Environmental Education*, 27(01), 24-45.
- Stewart, Alistair. (2011). Becoming-Speckled Warbler: re/creating Australian natural history pedagogy. *Australian Journal of Environmental Education*, 27(1), 68-80.
- Stewart, Alistair. (2015). *Rhizocurrere: a Deleuzo-Guattarian approach to curriculum autobiography*. *International Journal of Qualitative Studies in Education*, 28(10), 1169–1185.
- Taylor, Carol A., & Hughes, Christina (Eds.). (2016). *Posthuman Research Practices in Education*. London: Palgrave Macmillan.
- Thomas, Glyn, Potter, Tom G., & Allison, Pete. (2009). A tale of three journals : a study of papers published in AJOE, JAEOL and JEE between 1998 and 2007. *Australian Journal of Outdoor Education*, 13(1), 16-29.
- Tuck, Eve, & McKenzie, Marcia. (2014). *Place in Research: Theory, Methodology, and Methods*. London: Routledge.
- Weaver, John A. (2010). *Educating the Posthuman: Biosciences, Fiction, and Curriculum Studies*. Rotterdam: Sense Publishers.
- Weinberg, Steven. (October 8, 1998). The revolution that didn't happen. *The New York Review of Books*, 45, 48-52.
- Whatmore, Sarah. (2006). Materialist returns: practising cultural geography in and for a more-than-human world. *Cultural Geographies*, 13(4), 600-609.
- Whitson, James A. (Tony). (2006). Est-ce qu'il n'ya pas de hors-curriculum. Abstract of a paper presented at the Second World Curriculum Studies Conference: *Curriculum as an International Conversation*. Tampere, Finland, 21-24 May.
<http://www.uta.fi/laitokset/okl/tokl/wcsc/WCSCAbstract.pdf>
- Zink, Robyn, & Burrows, Lisette. (2006). Foucault on camp: what does his work offer outdoor education? *Journal of Adventure Education and Outdoor Learning*, 6(1), 39-50.

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