Latimer, J., & Miele, M. (2013). Naturecultures? Science, affect and the non-human. *Theory, Culture & Society,* 30(7-8), 5-31.

Naturecultures? Science, affect and the non-human

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Abstract

Rather than focus on effects, the isolatable and measureable outcomes of events and interventions, the papers assembled here offer different perspectives on the affective dimension of the meaning and politics of human-non-human relations. The authors begin by drawing attention to the constructed discontinuity between human and non-humans, and to the kinds of knowledge and socialities that this discontinuity sustains, including those underpinned by nature-culture, subject-object, body-mind, individual-society polarities. The articles presented track human-non-human relations through different domains, including: humans/non-humans in history and animal welfare science (Fudge and Buller); the relationship between the way we live, the effects on our natural environment and contested knowledges about 'nature' (Whatmore); choreographies of everyday life and everyday science practices with non-human animals such as horses, meerkats, mice, and wolves (Latimer, Candea, Davies, Despret). Each paper also goes on to offer different perspectives on the human/non-human not just as division, or even as an asymmetrical relation, but as relations that are mutually affective, however invisible and inexpressible in the domain of science. Thus the collection contributes to new epistemologies/ontologies that undercut the usual ordering of relations and their dichotomies, particularly in that dominant domain of contemporary culture that we call science. Indeed, in their impetus to capture 'affect', the collection goes beyond the usual turn towards a more inclusive ontology, and contributes to the radical shift in the epistemology and philosophy of science's terms of engagement.

The outrage that greets any putting together of 'animals' and 'human society' was made possible, according to Bruno Latour (2005), because the meaning of the term social went through a process of shrinking**.** In what he calls the sociology of the social 'we tend to limit the social to humans and modern societies, forgetting that the domain of the social is much more extensive than that' (Latour, 2005:6). In advocating a 'sociology of associations' able to account for the more heterogeneous nature of social actors and social links (see also Michael, 2000), Latour recalls the debate between Gabriel Tarde and Emile Durkheim in France at the beginning of the 20th century, a time when the field of sociology limited itself to the study of humans. Yet, as Mary Midgeley records, the tendency to banish animals goes back much earlier than to the period when sociology was establishing itself as a separate discipline:

> A generation ago, most academics would have been surprised to hear of a book with this title [Animals and Human Society]. Indeed, opinions in the learned world on this subject had not changed very much since 1787 when (as Maehle reports) 'many people could not understand at all how it occurred to an author to write about such a topic' (Midgeley, 1993, p. 186).

As with animals, so it is with other forms of the non-human. The all-pervasive interest in the human since the renaissance has over the centuries not only elided animals from much thinking about culture. It gave rise to a humanism that isolated 'man' and so erased the presence of other kinds as integral to the nature of dwelling (see also Ingold, 1996). Teubner (2006) goes as far as stating that:

> After the scientific revolution, after philosophical enlightenment, after methodological individualism dominating the social sciences, after psychological and sociological analysis of purposive action, the only remaining plausible actor is the human individual. The rest is superstition. (p. 2)

For all that sociologists and social theorists today have turned belatedly to the topics of the body and materiality, many agendas continue to be driven by such humanistic perspectives, perspectives that long predate Durkheim's success in establishing sociology as the *science* of human society. The clue is in this emphasis on science. At the same time as he attempts to reinsert notions of collectivity to get us out of methodological individualism, Durkheim imports a foundation for the discipline that not even Weber in his turn to meaning was able to reverse. As Albrow (1990) shows us, even for Weber 'the social' includes only those human actions that express rationality and excludes human's more 'animal traits', such as habituation and conditioning. Albrow emphasises Weber's inheritance of the Kantian division in ways that 'set up a fundamental cleavage between nature and the world of human action, where the mind's creative force was to establish goals and incite a striving for perfection' (p. 149).

Attempts to make animals stand up, or more generally get non-humans to speak as more than spokespersons for human interests, appear doomed to failure unless we also rethink the nature of science, social or physical, as itself a domain of culture. The concern for the contributors to this volume is thus not one of denying human characteristics in a vain attempt to add 'others' back into a common denominator. Or of our throwing off general perspectives on the non-human that are too anthropocentric, scorning attention to the like of chimps drinking tea or parrots speaking. Nor is it simply a matter of stripping away meaning as all too human, in favour of heterogeneity and the symmetry of Latour's (2005) double contingency, by giving non-humans the status of actants with the capacity to act differently from how they are already known. It is more that the very basis of our anthropology appears to limit the horizons of science to a particular (and dare one say, peculiar) set of relations.

It is for such reasons that Donna Haraway (2003) issued her Companion Species manifesto:

> Cyborgs and companion species each bring together the human and non-human, the organic and technological, carbon and silicon, freedom and structure, history and myth, the rich and the poor, the state and the subject, diversity and depletion, modernity and postmodernity, and nature and culture in unexpected ways. (p.4)

Haraway's agenda is far-reaching. While Haraway like Latour proposes attention to a new kind of heterogeneous idea of the social, and to a new kind of actor, the human-non-human hybrid, as 'associations' between 'beings' (Latour, 1998), she also adds something that is radical. Specifically, Haraway (2008) brings in attention to the affective dimension of human/non-human relations as a critical challenge to dominant knowledge practices. This bringing humans and non-humans together involves a rethinking not just of a 'politics of nature', as Latour (2004) terms it, but of a 'politics of culture' (Latimer and Birke, 2009) in ways that might take us far beyond that already achieved by attention to gender or orientalism, or even technology.

In their different ways, each paper in the collection explores how the relations between the human and the nonhuman (including animals, microbes, tissues, air and water) *affect* processes and

practices not just in the creation of socialities (Carter & Charles 2011a, b), but also in the production of scientific knowledge and understanding, is radical. Affect is being understood here not so much in its modern sense, as emotion or sentiment but rather in terms of 'attachment' on the one hand and being 'moved' on the other. The sense of affect being invoked thus contrasts emotion and affect, the former being individuated and the latter being both embodied and relational:

> . . affect is often taken to refer to a force or intensity that can belie the movement of the subject who is always in a process of becoming . . Although affects might traverse individual subjects, for many scholars they undo the notion of a singular or sovereign subject. (Blackman and Cromby, 2007, p.5)

The papers presented here stress attention to how, in scientific practices as well as in everyday life, it is also the human-non-human relations that are affective; it is these that move, incite, elicit and excite. Here then, with commentators such as Puig de la Bellacasa (2011), we are arguing for the importance of examining socio-technical assemblages as more than matters of interest, or even as a 'politics of things'. Rather, we also want to press attention to how people and things are moved about, and even transformed, as matters of affect. Taking account of the affective dimension of science is thus not a matter of simply reducing these affects to the status of 'not mind', as moments of precognition or non-representation (Thrift, 2007). This is because – as we go on to explore in our discussion of Strathern and naturecultures – affect signals a shift or alteration in attachment (in both senses of the word).

To continue the point, humans can never get themselves out of culture; all interaction, including dwelling itself, is to a certain extent 'prefigured' (Strathern, 1997) and no amount of reflexivity is ever going to 'disembed' us (Strathern, 1991). Hence the impetus to capture the affective dimension of human-non-human relations and associations in scientific practices enables us to explore interconnectedness (and its corollary, disconnectedness) as more than functional, or strategic. As such, our approach is not a matter of simply reverting to some kind of humanistic attempt to imbue the non-human with the capacity for meaning. Rather it makes possible what Venn (2010) terms 'the rejection of the anthropocentric divide between humans and animals, while avoiding species of sociobiologism, pre-formationism, geneticism and other monocausal paradigms' (p.1).

What are being contested in our turn to affect are the peculiarities inherited through the notion of 'man' that came into consciousness at the time of the Renaissance. This is the idea of man, heightened by Kant into a self-conscious, autonomous, individuated being – who, in the capacity for rationality was elevated above nature, and with it other species, by his (sic) accounting to the self for the self. Yet, far from being so immaculate in its beingness, an island unto itself, dwelling is always a matter of being not just in association, but 'in' extension (Munro 1996, after Strathern 1991). Selves are attached – in both senses of the word - to materials and other beings through relations that are both partial and provisional. That these relations, in turn, may be implicit and invisible, as well as transitory, should not diminish the importance of these 'attachments' and 'detachments', much as some might be validated and others denied in the paraphernalia of science.

Even in their postulated mode of detachment, discussed below, what this shift to include attention to affect helps us to see is how scientists, whether they be social or physical scientists, are always in the process of being what Sarah Whatmore, this volume, expresses as 'more-than-human'; and, commensurately, they – like the rest of us - act in a more-than-human world, including being positioned by socio-cultural politics. This more-than-human world is a world of materials as well as sentient beings, all of which need to be incorporated into the fold of a more inclusive understanding of the social, including into understandings of how, and what, knowledge is produced.

For all the general recognition that has accompanied the interminable deconstruction of Cartesian philosophies, the politics of the particular culture with which this Special Issue is engaged – contemporary science – continues to thrive on a denial of much of its relations. Within science only the mind's relation to logic (super-scribed by mathematics) is generally acknowledged; a relation that is supposed to have the effect of elevating the scientist sufficiently to cut out all other relations and attachments. This said, contemporary analyses of scientific practices show an increasing dependency of the scientist on her or his instruments (to say nothing of their embeddedness in the laboratory), a dependency that casts this matter further into doubt. Indeed, science more and more looks to be more than assemblages of associations. This is particularly so today when animals and non-humans, as is discussed later, cross over the subject-object divide to become the very instruments of the sciences, such as mouse models in genetics (Latimer 2013; see also Davies this volume) and meerkats in ethology (Candea this volume), affected in ways that makes them more the effects of culture than of nature. Symmetrically, therefore, they help indicate how a rethinking of culture has to be brought alongside a politics of nature.

Thus the argument for many of the authors in these pages is that understandings of power and domination need to be widened. Specifically, the authors look to science to include the kind of effects that are no longer directly attributable to overly narrow conceptions of the human. It is in this respect that this Special Issue offers an engagement with (post)human theory and research. Inasmuch as the research that follows stands as part of a more broad set of philosophies (Wolfe, 2010), calling attention to the persistent kind of premise that sets people apart from nature, we should be clear that the authors are not simply advocating posthumanism. Rather, as the bracketing of the 'post' in the previous sentence signals, the papers assembled are both 'in alliance and in tension with posthumanist projects' (Gane and Haraway 2006: 140). They are in alliance with some of posthuman philosophy's objectives in the sense that they exemplify the move to include the non-human as active in the creation of knowledge, as well as integral to the construction of worlds. This acknowledged, the papers seek to go beyond simply contesting the sense in which human difference is portrayed as qualitatively distinct, as belonging to a different 'social order' as Durkheim had it; or even as Weber might think it, with a special destiny on earth (Anderson 2001). In their impetus to capture affect, the papers go beyond either sociology of association or any turn to ontology (Woolgar and Lezaun, 2013). Rather, the radical move here is that attention to affect changes the terms of engagement to help deconstruct those dichotomies that rest on the polarizing of nature and culture, including subject-object, mind-body, individual-society, human-non-human dichotomies.

In what follows we situate the papers in their thematic contexts. The most prominent social philosophers of science with whom the papers engage are Despret, Haraway, Latour, Stengers and Strathern. We begin with exploring the connection and disconnection between nature and culture, moving on to ask "wither science", and explore how human-non-human, nature-culture, can be reattached, including new scientific methodologies. We then go on to show the importance of taking materialities and human-non-human relations seriously, but as more than functional matters. We finish with arguing for the significance of bringing affect back to science.

Re-connecting nature and culture

The papers presented preserve some notion of the human. While the authors deploy different ways to help illuminate how humans are just one amongst many other kinds of living beings, they also

note how their activities – including how they imagine their relationship to other kinds and to all aspects of the material world - have profound consequences. Critically, what each author addresses, is how the relation between nature and culture (and with this the human and the non-human) is enacted and performed as division and dichotomy. Such dichotomies prove inadequate for knowledge and understandings of sociality (see also Charles and Davies 2011), as well as mislead over how knowledge is produced inside the life sciences, social sciences or human sciences. Indeed, as is discussed below, the epistemology-ontology relation that is complicit in the production of division and dichotomy is also inadequate for addressing the problems that face not just social science, but also more general understandings about how humans live in relation to the rest of the world they co-inhabit (see also, Venn 2010).

This brings us to the primary invocation of our title 'naturecultures'. As Marilyn Strathern (1980), a leading anthropologist of science, advises, there are good reasons for avoiding perspectives that attempt to define either nature or culture as separable and distinct in themselves:

> . . . there is no such thing as nature or culture, each is a highly relativised concept whose ultimate significance must ultimately be derived from its place within a specific metaphysics. No single meaning can be given to nature or culture in Westernized thought; there is no consistent dichotomy, only a matrix of contrasts. (p. 177)

The aim of collapsing the dichotomy into one word is thus to suggest that nature and culture are not two different things, but a part of the same. For example, an individual human is not the product of the interaction of nature (body, biology, genes) and culture (nurture, education, technology). What we are insisting on is that any human being is a site of natureculture.

The term natureculture was coined by Haraway (2003) as a provocation for collapsing and transgressing the dominant metaphysics that dichotomizes nature and culture, and through which culture and all that is human is constituted as discontinuous with the rest of the world. As Haraway points out nature cannot stand outside of culture, just as culture cannot stand outside of nature. This is because the meaning of nature – what we identify as natural - is not just determined by culture, but is also the result of specific historical, material and political conditions of possibility. What humans identify as natural (claims for instance that women are naturally caring or that people are naturally heterosexual) is an effect of culture, but culture naturalized. But we would like to go further here.

Another way of undoing the nature-culture dualism is the recognition that we are one among many elements in naturecultures. Adopting this grounding for scientific practice does not mean for a moment that the nature-culture divide is not alive and kicking, exploited for instance to its limit in contests around environmental change and its causes (see for example, Uggla 2010). Rather, the group of philosophers advocating the collapse of the nature-culture divide claim to show us a way to knowledge that allows us to step into a new world, one which does not separate the social from the biological as can be seen in the epitaph from Donna Haraway's (2003) companion species manifesto, and one that its advocates claim is epistemologically, ontologically, and politically more ethical.

For example, Sarah Whatmore (this volume) is concerned to explore the importance of affective relations between different kinds, for their methodological as well as their ethical importance. Focussing on a flood management program in which she was a participant researcher, Whatmore emphasises how for Stengers good science is both politically and ethically grounded in specific practices. These practices do not simply involve shifts from a scientific method; rather they involve reimagining science as an engagement in relations, relations between the human and non-human elements in any given scientific endeavour. This is because, as she states, 'it is a mistake to posit

humanity as somehow separate from, and/or existing prior to, the world of things; the human comes into being *with* this world' (this volume page **). Here, good science is not just a matter of humans being in relation to non-human elements as objects that he or she observes. Rather, it is a matter of recognizing, being open to and even promoting in any research design how these relations affect how and what knowledge is produced. Thus any scientific endeavour is a matter of making explicit how different elements affect each other, as a form of becoming-with. Whatmore also makes explicit the interested nature of science – that it is neither detached nor disinterested. Rather, making explicit how the concerns and interests in which science is entangled, and which any scientific project helps constitute, helps science to become more reflexive about the worlds that their attachments and detachments, whether these are mouse models or the emotions of cows, bring with them (Puig de la Bellacasa, 2012).

Whither science?

As already discussed, the term natureculture signals the current issue is concerned with the new philosophies that interrogate the discontinuities between nature and culture/human and non-human embedded in contemporary everyday life and in science. These philosophies understand it is not enough to announce, in a moment of prolepsis, the end of science:

> But this was to be no more than a brief period of Euphoria, a golden age with no future, in which seeing, saying and learning to see by saying what one saw communicated in an immediate transparency: experience was rightfully science; and 'knowing' was in step with 'learning'. (Foucault, 2003: 117)

At the same time as they do not stand against science, the new philosophies offer critiques of science as needing to change their orientation and outlook, by becoming for instance 'cosmopolitical' (Stengers, 2010). For Stengers, cosmopolitics is a 'planet eye-level' (undated) that can help counteract the problem of turning modern science into technoscience, as a general model of objectivity, rationality and universality. To this extent the papers collected here extend new understandings of the human-non-human relation (ontology) in the production of knowledge (epistemology) and in its application as technology.

For example, in her paper Vincianne Despret (this volume) describes some of the 'un-orthodox' practices pioneered by Konrad Lorenz and adopted by ethologists such as Barbara Smuts (2009) and Farley Mowat (1981), who openly used their bodies for engaging with the animals they were studying. Despret calls these practices 'affected perspectives' that make explicit what is usually hidden: how the scientists' bodies are affected and changed in their practices. The paper raises questions about how scientists mention or conceal their bodies in the conduct of their research, why they do so, how they 'use' them, and what 'having a body' means in relation to scientific work. Despret offers the thesis that using the body as experimental tool (either for a wolf's diet of mice or for marking a territory with urine, as in the case of Mowat's study of wolves) might help to change the questions asked about the animals scientists study. Specifically, Despret unfolds a way of doing science that undercuts the usual option of keeping the objects of study intact as models of nature through methods of habituation, to show how there are times when it is important to become, partially and intermittently, not just with the animal, but to become animal. She describes experiments in which the scientist does not just inhabit the animals world, as observer, but allows the animal world to inhabit them. What Despret shows us is how the body and practices of the scientist, as they allow the animal world to inhabit them, is also treated as an instrument – with the affects of becoming animal observed, measured and recorded. So that through switches in practices, there are switches in attachment – from being inside and immersed in the world of the animals

being studied, to a world of science that makes sense of that immersion through application of its own kinds of belongings and practices – measurement and other modes of reporting. But critically, as Despret stresses, the first mode is a method, one in which the scientist actively seeks to become with the animals and, critically, she shows how for them to affect her to help make her a *member*, requires participation in their world, not detachment. Unlike in the usual representations of published science, this method is not then erased, annulled by the second mode – that of reattaching to modes of science, rather it is made explicit as crucial to an adequate epistemology.

There are two ways then in which this critical attention to science is of special importance to the dichotomization of nature and culture. First, the scientific method has been held out, globally, to be the only sure path to knowledge and representation. Its ubiquitous evidence base is thus taken to be the only firm ground upon which to intervene. For instance in the political imagination of Western governments, science gets *blackboxed* as Science with a capital S, with little attention as to what counts as good or bad science, either in terms of how it affects our dwelling in the world or in the sense of appraising its conduct more generally. Second, 'science' is also the locus for the production of technologies for *intervening* in the world. Science, in its contemporary incarnation, is constituted by theorists like Latour (2004) and Stengers (2010) as deeply implicated in the invention of technologies with which to manipulate, intervene or enhance nature. Science in a sense in its detachment has got out of hand – it is no longer the science of Foucault's 'golden age' cited above. Indeed, the technology-technology machine that science has become in many of its guises – and the interests that fuel its constant expansion - is identified over and over again as a juggernaut that is out of control.

Breaching hybrids and wholes

Examination of the scientific practices that underpin the complicity of this blackboxing and intervening is important then not least because science is not just another domain of culture. As already discussed, scientific practices are also the foundry in which human exceptionalism is fabricated and enacted as a specific relation between either culture and nature or human and non-human others. Science in the cultural imagination is no longer only dominant in the West; in a number of senses it is the harbinger if not the emperor of a capitalism that is rapidly going global. As the highest achievement of human endeavour – the epitome of human accomplishment – it represents itself as being as far from nature as it is possible to get. At the same time as its objects and materials are those that are made to stand for 'nature', our own as well as the physical world.

Decidedly, in looking for a shift in the epistemology-ontology relation, and towards notions of what can count as 'scientific' methodology, Whatmore and Despret in their insistence on a 'becoming-with' attempt to re-incorporate interconnectedness into the methodology of science. But those organizational practices that we call 'science' and in which non-humans are explicitly the focus, the papers by Buller, Candea, Davies, Latimer and Whatmore also each show how what gets enacted are very complex relations between the human and the non-human. They each unpick shifts that re-perform the nature-culture dichotomy and draw attention to the kinds of science that remain dependent upon asymmetries between subject and object, and human and non-human. These approaches then do not simply observe scientific practices, they also set out to transform the relations between humans and the world that scientific enterprises perform.

For example, Joanna Latimer, this volume, questions the implicit totalizing involved in simply pressing recognition of interconnectedness, being-with and hybridity. In so doing she articulates a more nuanced position in her notion of 'being alongside'. Latimer begins by exploring why it is so important to bring the animal into sociology, particularly as the prototype for most forms of

Othering. She reflects upon inquiries into the human and the animal for how they critique human exceptionalism, and suggests a movement toward an ontology of connection rather than division, that stresses the relation between human and non-human others. She shows how in the new evolutionary biologies this connectivity, enacted in terms of shared substance, still manages to perform a hierarchy of values through which only some animals are brought into the fold of humanity. She explores a possible way out of this impasse as a way of doing human-non-human animal relations in terms of being-with. Here, extending Haraway's (2003, 2008) theory of Companion Species, Latimer critiques advocacy of 'being-with' as too totalizing and individuating. Drawing on her study of Olivia Musgrave's sculptures of Amazonian women and their horses, she goes on to offer a new ethical as well as existential understanding of human/non-human animal relations. Drawing on the work of Marilyn Strathern, Latimer suggests how being-alongside (as opposed to being-with) emphasises the partiality and intermittency of the connection between the human and the non-human; underlining in so doing how the human and the non-human animal remain different and always in tension. Thus her focus is on how there are neither individuals (humans or non-humans) nor hybrids (companion species), but rather assemblages made up of intermittent attachments and partial connections. Her philosophy captures how scientists can only ever partially (in every sense of the word) become-with the animals they study. For instance papers by Despret (discussed above) and Candea (this volume and below) show scientists switching from attachment to the animals' worlds back to a re-attachment to their own belongings of observation and measurement, even of their own faeces. These partial belongings are captured by the notion of being–alongside because it emphasises switches in ground, and expresses the limits and the partialness of any connection (also invoked by Whatmore's paper) and of any sense of mutuality.

These philosophies proposed by Whatmore, Despret and Latimer of becoming-with and being alongside respectively, thus do not entail our standing outside or against science. To the contrary, the authors in this volume help us recall how we are never without science in our everyday lives, neither in terms of how we live, our own imaginaries and knowledge creations, nor in respect of those of the scientists we study. Rather, their engagement is with a reflexive project concerned to open new ontologies that help us rewrite the division between nature and culture and incorporate new ways of understanding the relations between the vitality of the material world and the human. As already indicated this is to provoke a way of thinking in sociology that no longer dichotomizes the cultural and the natural (or the social and the material or the human and the non-human), but begins to take more seriously the idea that we live in and are a part of naturecultures. For instance, another leading anthropologist of science, Paul Rabinow (1992), has pressed attention not to the sociology of biology, as might be expected, but to how we need more than ever to think of ourselves and our futures in terms of biosocialities.

To this end the papers also recognize that the ways in which relations are performed in social science mirror the dominant modes of ordering relations in the physical sciences, including all that they cut out (Strathern 1980) in both theory and practice. As well as focusing on the epistemology-ontology relations in the sciences with which they are engaged, Candea, Despret, Latimer, and Whatmore (all this volume) press the importance – substantive and political - of scientists' attending to their own methodologies and their attachments, including how their attachments sustain the economic and political machinery in which they are 'entangled' (Pallí Monguilod, 2004; Stengers, 2010). This is not only to examine the kinds of knowledges and technologies produced, but also to reflect on how they themselves are rewriting relations between nature and culture, body and mind, or people and ecology. The aim is to finds ways to become more (than) human (Whatmore this volume; Seaman 2007).

Taking materialities seriously

Insertion of the term 'naturecultures' also situates the Special Issue in a tradition of research that takes materialities seriously. This includes our own permeable, fragile materiality as bodies; bodies which, as Latimer (this volume) insists, are always in extension with technologies and other non-humans that, in turn, have their unintended as well as intended effects. The term natureculture thus helps to evoke an awareness of the dominant relations humans have had with the material world as at the same time it is intended to advocate a transformation in those relations. The term natureculture thus signals how humans – and everything that humans are and do - are always in connection with the other non-humans that make up the world at any one time. For example, the shift to the natureculture perspective lets us see, first, how there is no 'nature' that is not touched by what humans do as well as think and, second, that there is no part of being human that is unaffected by its material interaction with other materialities.

The importance of deconstructing the nature-culture dualism is thus partly because of all the other unjust dichotomies and dualisms that flow from it, including iniquitous regimes of value and asymmetrical feminine-masculine dualisms that underpin gendered power relations (e.g. Braidotti 2002). On the one hand we can see this natureculture relation expressed in theories of embodiment that attempt to collapse the mind-body or other inside-outside binaries such as the subject-object divide discussed below. On the other we can see it expressed in examinations of dwelling that are opposed to dichotomizing human-environment relations. As Heidegger's (1996) notion of 'standing in advance' suggests, humans in modernity increasingly stand in a relation *to* (not *with*) nature. So much so that nature, including human nature, becomes a resource, to be known, mastered and exploited. Just as there is no aspect of human being that is not a part of and in connection with the material world, so there is no corner of the earth that is unaffected by the human (Adam 1997); from the icecaps to the rain forests, the effects flowing from human technologies travel over time and across space, going global, for example in the form of acid rain. Contemporary geology here goes so far as to name the impact that humans are having on the world's ecosystems as the 'anthropocene' (e.g. http://www.anthropocene.info/en/anthropocene).

In these ways the trope of natureculture performs a provocation, flagging up the need for new cosmologies, political and personal. As Despret, Whatmore and Buller each show in this volume, the current dominant relation between nature and culture performed across so many domains of science needs shifting. At the very least these papers, each in their different approach, signal ways to incorporate the idea that we inhabit what Bruno Latour (2004) calls 'worlds in common', worlds populated by human/non-human relations, and learn how to speak in the 'language of dwelling' ('*oikos-logos'*) (p. 213).

The need to bring science into democracy as a collective of human and non-human relations, is particularly apposite for science. Science is the domain in which the dichotomy between nature (animal and other non-humans) and culture (human) is most fervently enacted as a relation in which human knowledge of the world (and ways of representing it) affords humans the maximum means to develop technologies for intervening. The pinnacle of culture is thus seen – from this perspective - in this relation between nature and culture: the one in which scientific knowledge supports the development of technologies with which to master nature and enhance human being. Just think of Kubrick's image in *2001 Space Odyssey*, where the ape-man finds the long bone and turns it into a technology, as an image of the dawn of a technoscientific culture, *ours*.

To this end the question mark after the term naturecultures in our title also indicates that several of the papers are asking *how* the relation between the human and the non-human is being accomplished inside different domains that are explicitly entangled by scientific discourses. In this respect the ethnographies which make up the papers in the Special Issue hold contemporary

scientific practices against the social philosophies that advocate attention to the non-human as participants, and of humans as needing to open up to their affects.

The two papers by Matea Candea (this volume) and Gail Davies (this volume) help elaborate the complexity here in terms of very different spaces and organizational forms of science. Candea presents ethnography of an ethology field station, one where the animals are meerkats, who are trained one moment to participate in an experiment over food, and then observed the next as creatures in their natural habitat, merely habituated to the presence of humans. Thus the ethologists in Candea's paper are one minute in a relation of collaboration with meerkats, and the next in one of detached observation. These shifts show that each mode of connecting and relating to the objects of science is partial, and intermittent, but are made invisible in the production of knowledge about meerkats as exemplifying a specific kind of animal behaviour. These shifts in ground make manifest different kinds of relations, including how different modes of doing science affect both ways of being with non-human others as well as who or what those non-human others, literally as well as figuratively, become.

Davies shows how in her study inbred mice, and their genetically altered offspring, have attained a very special universality, with their adoption into international scientific networks as 'an ordinary commodity in the exchange circuits of transnational capital [...] a scientific instrument for sale like many other laboratory devices' (Haraway, 1997: 79)' (this issue, page ***). This is a particular way of what Haraway has called 'becoming worldly', as mice developed in one laboratory become standardized technical tools that move from research centres to specialised laboratory suppliers, to become the patented property of international biotechnology. In Davies' account, 'Mice are part of the story through which biology becomes molecular, genetic life commodified and genetic explanations fetishized' (this volume, page **). However Davies' paper also shows how these non-human others, these laboratory mice, affect scientific knowledge in ways that create a profound imbroglio in biomedical research practices. In particular there are spontaneous mutations in the mouse house, figured in scientists' and technicians' stories as deviant, mutant, virgin, and rogue mice, and she shows how technicians and scientists deal with these unexpected creatures in their work. Davies explores when the animal caretakers are able to see the biological potential of the mice, and how the new guests in the mouse house facilitate the emergence of a useful new strain of research animal; and when the caretakers do not see these mutant mice as having potential because they have no interesting new features, and are killed. Davies relates these two ways of dealing with the unexpected to different forms of organization. In this way, she illuminates how the non-human is affected by, and when they affect, the research. Stengers and Latour both articulate this in terms of 'good' scientific practices that address and make visible how and when the so-called 'objects' of science object (Pallí Monguilod, 2004), in the sense of making an objection, to the experiments they are a part of, and through which the scientists' are affected and their understandings, even their modes of experimentation, are transformed.

These papers thus help illuminate that scientists and the non-human others with whom they are in association are never simply engaged in the making of one world together in any particular endeavour, but alter between different worlds which have different demands and different logics. These shifts alter the figuring of both the objects of science as well as the character of science itself. What emerges, then, through both Davies' study of mouse models and Candea's study of meerkats at an ethology field station, is not simply one way of doing relations between scientists and the non-humans in their projects, but shifts, shifts that hide how scientists and animals become differently from how they are usually depicted.

Reattaching Science

As can be seen from the papers discussed so far, a second and further aim of the collection is to bring to the fore how scientists are not just interested in but concerned with the non-humans in their worlds: that they have to be *attached* and *affected* in order for their experiments to work, not all the time but some of the time. So what the papers in this volume address is the need not just to open up social science to thinking with the non-human, but the need to reimagine and explore the kinds of worlds that are created by how the division between the human and the non-human, scientists and their objects, culture and nature are enacted and performed inside scientific endeavours for the kinds of knowledge produced. This is important politically and ethically, philosophically and practically.

As others have shown 'nature – culture' is not performed as a binary but as a key dualism that is implicated in all the other key divisions underpinning flows of power, including the asymmetrical relation between the human and the non-human (Callon, 1986). Thus the nature-culture/non-human-human dichotomy or dualism does not just make us epistemologically impoverished, blinding us to knowledge and understanding, it is the foundation from which processes of exclusion flow, and upon which the 'attitude' (Foucault 1984) to the 'non-human' is founded; an attitude that figures the non-human, such as the mice in Davies' study, as resource, and as available to mastery (Heidegger 1986) in ways that legitimate its exploitation. The scenario is set for what Latour (2004) has called a politics of nature, including an 'ideology of conquest and domination towards nature' (Pattberg, 2007: 1).

At the heart of the different philosophies of 'being-with', 'becoming-with', and 'being alongside', mentioned earlier, is a challenge to the scientific attitude of *detachment* and, with this, an attempt to reverse the exclusions brought about by the subject-object divide. In this respect, a third purpose of this Special Issue is to focus on the issue of affect, especially where other sentient beings (such as non-human animals and the worlds that they make) are brought alongside humans in the creation of knowledge. For all recent attention to the place of the non-human in the ordering of social relations is bringing about better understandings of how different human and non-human elements are assembled into complex socio-political associations (Latour 2010), it is fair to say the focus has been largely on technologies and other materialities. It is only with difficulty that more intangible aspects of relations, such as concern, otherness and affect, get re-admitted to understandings of assemblages and their effects.

For social theory and methodology, as Verran (2009: 11) argues, this step means that it is not enough simply to attend, with, for example, actor network theory, to the place of the non-human in the ordering of relations, as a 'politics of things'. Rather, Verran helps us to see that the principles of science need to be extended beyond its own flat ontology, by attending to the metaphysical, particularly the moral forms, embedded in and reproduced by specific forms of knowledge practice. There are different ways in which this can be done, for example by attending to what it is that scientists care for (Latimer and Puig de la Bellacasa 2013). It is through an 'ontic politics' that the boundaries of inclusion can be opened to the relational practices through which some things rather than others come into existence. In Verran's case disconcertment, those moments when things feel wrong and unsettling, is an essential part of doing good (ethically, epistemologically) research (see also Law 2010). Krarup and Blok (2011), in also aiming to extend actor network theory, press for the inclusion of what they designate as 'quasi-actants', those non-empirical or virtual elements, such as symbolic and moral forms, that have affects on how any form of organizing is done.

The upshot is to make explicit how scientific practices perform the human and better examine the consequences that flow from how the relation between the human and the non-human is being constructed. Here Erica Fudge (this volume) beautifully describes the historical slippage of the cow,

from a being with a face, to a resource, effaced and without dignity. Fudge addresses the constructed discontinuities between human and nonhuman animals by referring to the 'facelessness' of animals in Western philosophy and modern science (Bacon) because 'a face is where the rationality that lies within is projected out into the world, and here there is no reason to project and so no face'. As Fudge goes on 'Lack of reason means lack of face, means lack of individuality, lack of home, which in turn means that these beings are outside of full ethical consideration.' (This volume, page **). In the examined wills Fudge uncovers the clues, such as the naming of specific animals, that might be intimations of a different type of relation between human and nonhumans, one in which nonhuman animals might have been considered subjects with a 'face', entitled to ethical considerations. Thus by giving animals a face, by individuating them as subjects, they can be reincluded in the fold of humanity

The 'effacement of the face' (Bauman, 1990) of farm animals is also a theme present in Buller's paper. But for Buller, in contrast to Fudge, giving an animal a (humanized) face is a part of the problem. He argues that simply giving animals an individuated identity is an effect of the anthropological machinery of animal welfare science. Specifically, Buller points out how the 'singular 'farm' is increasingly a place of ever‐greater multitudes, a deceptive and porous whole that is, in so many ways, very much less than the sum of its constituent parts' (this volume, page **). His analysis of the industrialization of animal farming and the problems emerging from the ever greater number of animals kept for food production (Fraser, 2006) is linked to the rise of the public concern for the welfare of farmed animals and the development of animal welfare science. Buller proposes a critique of the recent 'feeling' approach in animal welfare science (see Duncan, 2004) that is based on an appraisal of the emotional state (e.g. happiness, fear, boredom) of individual animals. He points out how this approach, that is met with favour by the public (see Miele 2011) is too individuating. It is also for Buller a decoy that obfuscates the need to investigate animal 'collectivities', and the very conditions of life of the ever-larger flocks of chickens, herds of cows or 'cities' of salmons, and how their 'wants' or 'feelings' are emerging from the interaction between them and the environment in which they live. Buller concludes that:

> ..these 'animals' wants' (as opposed to 'needs') are increasingly being understood as socially contextualised, rather than purely individual yet they are not only increasingly denied within modern animal husbandry practice but also escape scientific investigation and consideration. (this volume page **)

Bringing affect back into science

A fourth aim of this set of papers is to trouble the processes that help produce the above-mentioned techniques of detachment in the natural and social sciences, a distanciation that produces the figure of the flâneur – as if the 'human' can stand outside the rest of the natural world, disinterested and objective. It is when this relation of the human to the rest is enacted in science, as being at the heart of the scientific method, that the 'anthropological machine' (Calarco and DeCaroli, 2007, Agamben, 2004) is most at work. Yet the point is not only to help deconstruct the 'humanist exceptionalism' that is integral to the dichotomizing of nature and culture, animal and human. Rather, the object of the various papers here is to foreground the non-human as *participant* in the worlds – scientific or otherwise - they inhabit and help construct.

The subject-object divide that lies at the heart of much humanism is of course not peculiar to science. Its origins lie more in a grammatical division in language between *subject*, which does the doing and *object*, to which things are done, including observation, experimentation and measurement. The division thus typically separates those beings accorded the honour to be sentient (generally those

humans accorded the status of sovereign subjects) from those which are not (generally non-humans). Consequently, in a sleight of the English language, it is worth noting that on the one hand objects are generally taken as being moved about by *effects* and on the other only subjects – typically humans - are seen as subject to *affect*.

This acknowledged, the rise of science might have had as much influence in practice over common usage of these twin terms, almost erasing its difference in meaning in much discourse. Hence it is surely no accident that those interested in affect have returned to a philosopher dating back to a time before science became the dominant force in the expansion of knowledge? As with previous papers in *Theory, Culture & Society* (see for example, Ruddick 2010) Spinoza's sense of affect is invoked by a number of papers as moments in which there is 'an alteration in power by affectus'. This is because *affectus* is defined by Spinoza as 'the affections of the body by which the body's power of activity is increased or diminished, assisted or checked, together with the ideas of these affections' (Spinoza, 1994). Inasmuch as the reductionism inherent in Cartesian methodologies tends to cut the 'whole' into 'parts', the rise of science has contributed to an effacement of the very kind of attachments to which Spinoza is pointing with his term affections. This point needs some further comment.

Much has been said in the history of science about the way in which science focused on the 'efficient' cause and has relegated Aristotle's other three causes (material, set-up and final cause) to the dustbin. This has been seen as a straightforward consequence of the mode of reductive analysis, which (in breaking down the whole) 'detaches' each part from the other in order to form clear and distinct 'simples'. Equal attention, though, might be given to an evisceration of the notion of affect from scientific language, whereby it is only the 'effect' of one part on another that is studied – much as Hume detailed one billiard ball being moved about by another. This predilection is largely attributable, in a circular fashion, to the importance of measurement in science – since it is effects alone that are deemed to be measurable. Contrastingly, affect, where it is used at all, typically indexes the holism of an overall reaction; a state in which someone feels 'turned over' rather than just merely turned around. Indeed, in following up this idea, Munro and Belova (2008) suggest there is an immanent if momentary loss of narrative in the body and go so far as to suggest affect is where 'world' is changed.

The very idea of the experimenter being 'turned over' is clearly an anathema to science. Hence the idea of affect has long been treated as an aberration (particularly so since it was mistakenly assumed to occur only in sentient beings – the subject side of the subject-object divide). Affect implies a temporary loss of sovereignty, even rationality; and so becomes the enemy of science.
Thus to go further than Latour, as discussed in the introduction, it is not just heterogeneity that is expunged from understandings of how science is done, what is also expunged from understandings of science and technology is an interest in affect. Specifically, attention to affect allows us to bring into view how the relations between the different elements of any scientific endeavour are never only objective or functional. Rather attention to affect helps us bring into view the ways in which each element acts on the other, to be moved, and even transformed.

Making explicit how scientists are affected by the non-humans and quasi-actants that make up the worlds they inhabit, and vice versa, troubles the basic premises upon which science operates. For example, the ethologists in Candea's paper are one minute in a relation of collaboration with meerkats, and the next in one of detached observation of the same meerkats that their experiment has transformed. These partial connections, attachments and detachments are also captured by Latimer's notion of being–alongside, because it expresses the limits and the partialness of any connection and of any sense of mutuality. By attending to the affective, distributed and heterogeneous nature of scientific endeavour what gets unconcealed are those aspects of

knowledge practice that in the mode of ordering we call science are usually inexpressible and invisible, and cut out of how science is understood and performed.

Crossing the subject-object divide

In the stress on 'objectivity', measurement procedures in science open up a front door whereby those humans who do not conform to scientific protocols are taken to be 'irrational' and passed over to the other side of the subject-object divide, thus becoming 'objects' of study for the human sciences. Yet, if on a somewhat different token, measurement also opens up the back door through which non-humans cross over the subject-object divide. In an enslavement to their instruments and their tried and test protocols, scientists are bound by their conventions to go with the measurements, it is not the scientists that first register and record but their *instruments* – the non-humans that are seen to be aligned on the same side of the subject-object divide as the scientists.

These procedures might cause little reflection but for the fact that increasingly, in fields such as genetic biomedical research, it is sentient beings – animals going ahead of humans – that have become the instruments. Here, Davies and Candea as we have seen both describe how different scientists 'model' animals to a greater and lesser extent, so that the animals are in turn affected by culture (to a greater or lesser extent). As such they can no longer stand for nature. But these same animals (genetically engineered mice, and collaborative meerkats) then become the instruments through which scientific experiments are conducted, but with the trace of their humanization erased (Derrida 1978). Thus scientists switch between the making of their animals fit for their experiments and the re-inclusion of the animal as scientific instrument. Without wishing to labour the point, even in the so-called hard sciences of biology and chemistry, the registers of affect have been busy re-entering by the back door. Elsewhere in her study of genetic medicine Latimer (2013) explores this motility in the subject-object divide.

Yet as Candea (this volume) helps remind us, though further switches in ground the objects of science are not the materials and creatures that the scientists employ and study in their experiments. The materials and creatures scientists use in their experiments are constituted discursively as models and instruments, employed in experiments to help extend, confirm or refute particular puzzles, hypotheses and theories: it is the puzzles, the theories and the hypotheses themselves that are science's objects. What he shows is how the instruments, the meerkats, also have to become participants for the experiment.

What these new ontologies explored in this Special Issue thus provoke is attention to how the creatures and the instruments are not just that, instruments, but participants in the worlds of knowledge that they inhabit in ways that affect the knowledge produced because they affect what the humans think and do. In this way the mode of detachment takes the subject-object division one step further than is usually noted. Its all-embracing denial of affect in the work of scientists is tantamount to a 'cutting' of the network (Strathern 1996); the 'true scientist' is incited to banish all relations other than that of measurement. In ways that resonate with the discredited doctrine of logical positivism (which sought to banish meaning as metaphysics), the more positivist scientist is not only in hock to what can be measured, but holds out observations (measurements) as purified of any 'subjective' affect. Since it is only the objects in an experiment that are deemed to be movable, only the effects on the objects are to be measured. Paradoxically, the same objects are sometimes also discussed as the 'subjects' of the experiment – as if the experiment has not only taken the place of sentient beings but becomes itself the prime mover.

Concluding comments: towards a more inclusive science

The shift in philosophy of science with which the papers that follow are engaged is thus not just about bringing the animal and the non-human alongside class, race, and gender to help reorder sociology, philosophy and social theory. Rather, the shift in approach that is being encouraged, in both scientific practice and in the epistemology and philosophy of science, extends to the part that the non-human plays in the ordering of social relations as well as in the production of knowledge. What the papers explore and propose are different ways not just of investigating science as the object of science and technology studies, but how science can be understood *and* done differently. This is expressed in terms of both how relations are imagined and included in a scientific endeavour, particularly in terms of affective interactions between the human and the non-human, in the now of the scientific enterprise, but also in terms of how humans live in and affect the worlds that they inhabit.

For scientists to make explicit how the objects of science both object to and address their affects is thus a kind of rigour, a test of the saliency of a scientific practice (see also Davies, Candea and Whatmore, this volume). This is not for the authors in this issue a matter of simply pointing to the socially constructed nature of scientific knowledge, or the ways in which culture is already inside science, articulated for example in terms of science's imaginaries (Verran, 2009), as important as these matters are. Rather it is about understanding *how* the specificities of the relations among the different elements of a scientific endeavour (being assembled, composed and imagined, as associations and disassociations), affects a) the kinds of experiments being done, b) the interpretations of their significance and c) the knowledge and understandings produced. In this sense what is happening here is to do with a politics of imagination (Latimer and Skeggs 2011): specifically, that the ways in which the relations are imagined inside science, particularly over who or what is affecting who and what, will change the kind of science being done.

What is on offer in this volume therefore is not the kind of 'descriptive' or empirical project advocated by Latour (see also, Krarup and Blok 2011). Rather, for social scientists and philosophers of science such as Despret, Stengers and Haraway, engagement with the process of science is a matter of activism: a way of affecting how science is done to ensure that it is 'good', in every sense of the word. This is not just to admit the contingent, historical, interested and localized rather than universal or logical character of science, as if it holds to absolute moral values of freedom, objectivity, disinterest, rationality and progress; limited, and bounded by time, space and culture (Cunnigham and Williams 1993). Rather, it is to offer ways of doing science that are more inclusive, so that those elements previously excluded and shut out of knowledge enterprises, the 'neglected things' (Puig de la Bellacasa's, 2011), will now be included. This 'posthuman sensibility' as Braidotti argues (and also Whatmore this volume), points to '…a new way of combining ethical values with the well-being of an enlarged sense of community, which includes one's territorial or environmental inter-connections.' (2013: 190).

Understandings of what counts as 'good' science are based upon participation with scientists and an unconcealing of how 'good science' actually works (see Stengers, 2010 and also Thompson, forthcoming). Moreover, Despret and Whatmore (this volume) show (with Isabelle Stengers) how scientists *need* to be more 'response-able' (Latimer 1999) to these affects; response-able for the kinds of worlds they are helping to create and for the knowledges that they claim. This is because science is a site of crossing: the ontological-epistemological relations performed by scientific methods are produced by and reproduce particular ethico-political worlds. The idea underpinning the papers in this collection has been to show that attention and concern for making human-non-human relations explicit will help produce both better knowledges *and* better worlds.

The overarching aim of the Special issue is thus that these different perspectives might not just change how non-humans are seen and involved in the stuff of science in ways that will not simply subject them to the 'anthropological machine' (Agamben 2004) as spokespersons of human's interests and concerns. It is also about unconcealing how good science is done. And this is a matter of resisting how scientists and science is positioned by the division of the object-subject divide, through a focus on the affective in the constitution of knowledge (see also Bell 2012). That relations between scientists and their objects are affective would have been, until recently, almost impossible to think. It would seem to go against everything that the elaborate machine for modern scientific method stands for: objectivity, distantiation, and the elevation of technologies that measure, manipulate and intervene. As we already know, not only are the affective aspects of science made invisible in the translation of science into publishable science or 'evidence', they can be, as Davies this volume shows us, simply cut out of contemporary forms of industrialized 'big' experimental science, as if practices, animals and their technicians can be made machinelike, with scientists as centred and objective subjects.

It is thus in this sense that the papers here contribute to a radical move in the philosophy of science: through a turn to a focus on the affective as well as the heterogeneous and distributed dimensions of knowledge practices, these new philosophies of science are not just addressing ontologies of connectivity, or the decentering of the subject, they are offering possibilities for changing the terms of engagement in how science, social or physical, is done.

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