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Defying Control: Aspects of caring engagement between divergent knowledge practices

Saurabh Arora

Practices



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In recent years, the notion Anthropocene has been celebrated for its potential to bridge modern divides between nature and culture as well as critiqued for embedding the fallacy of human control in its nub. Building on these recent debates, and using insights on ontological pluralism from anthropology and philosophy of science, I outline four conceptual aspects for enacting caring engagement between divergent practices. These aspects are: a) *egalitarian commitment* to sharing epistemological authority between practices; b) *ontological sensitivity*, by letting other practices define their own relational bases of knowing and making; c) nonsubsumptive learning from other practices; and d) *affinity in alterity*, developed across widening divergence between practices. I argue that caring engagement may be central to transforming 'modernist' techno-scientific practices that are constituted by an ethos of control and by disqualification of diverse ways of knowing/making. Relinquishing control and disqualification, modernist practices may undergo transformations to become *minoritarian practices* that admit uncertainty, ignorance, ambiguity, fluidity and fragility. In mutual engagement with each other, transforming minoritarian practices may become generative of diversity in the form of novel knowing/making practices immanent to their own heterogeneous worlds composed of human and nonhuman forces. Such unbounded ontological pluralism will not be realised by adopting aspects of caring engagement as fully-formed principles, but rather by admitting and reworking the aspects as open questions that find relevance in ongoing natural-cultural struggles for sustainability and emancipation.

About the author

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Abstract

In recent years, the notion Anthropocene has been celebrated for its potential to bridge the modern divide between nature and culture as well as critiqued for embedding the fallacy of human control in its nub. Building on this debate, I explore conceptualisations of action and interaction which attempt to move beyond the nature-culture divide and the fallacy of control. By focussing on knowing/making practices as performed by heterogeneous collectives composed of human and nonhuman forces, I sketch four aspects of caring engagement. These are: a) *egalitarian commitment* to sharing epistemological authority between practices; b) *ontological sensitivity*, by letting other practices define their own relational bases of knowing and making; c) *nonsubsumptive learning* from other practices; and d) *affinity in alterity*, developed across widening divergence between practices. I argue that enacting such caring engagement may require transformations in ‘modernist’ techno-scientific practices underpinned by an ethos of control and by disqualification of diverse ways of knowing/making. Relinquishing control and disqualification, modernist practices may be able to become *minoritarian practices* that admit uncertainty, ignorance, ambiguity, fluidity and fragility in engaging with each other. Through caring engagement, divergent minoritarian practices may thrive and intermix to innovate new ways of knowing/making that may be crucial in furthering distributed struggles for socio-ecological sustainability and justice.

Keywords

Care, ontological pluralism, minoritarian practices, ‘vernacular practices’, ‘indigenous knowledge’, Anthropocene, climate change

1. Introduction

On 29 August 2016, 30 out of the 35 geologists belonging to the Anthropocene Working Group (AWG) of the Subcommission on Quaternary Stratigraphy voted in favour of formalising a new geological epoch. The members of the AWG unanimously agreed, with one member abstaining, that the Anthropocene was 'geologically real', at least since the start of the 'Great Acceleration' in the mid-twentieth century (Zalasiewicz and Waters 2016). They believe that humanity's impact on the Earth in the last seven decades is significantly greater than in the previous epoch, the Holocene, which lasted roughly 12000 years.

Other geologists may disagree with the AWG regarding the starting year of the Anthropocene (Lewis and Maslin 2015; Oldfield 2015), but do not dispute the 'general scientific agreement' that the recent impact of human behaviour on the Earth, its composition, its land uses, its sea levels and its other species, is profound (Maslin and Lewis 2015). These changes are already considered critical for most living beings on the planet, but the impacts are deemed particularly severe on those who are most vulnerable (Arnall *et al.* 2014; Hallegatte *et al.* 2014; Macdougall *et al.* 2013). Alongside many nonhuman species undergoing what is referred to as the sixth great extinction (Kolbert 2014), those considered vulnerable include rain fed farmers, small-scale fisherfolk, forest dwellers, people unable to protect themselves from heat waves, and 'indigenous' peoples living in ecologically sensitive areas (Adger *et al.* 2006; Salick and Byg 2007; Douglas *et al.* 2008; Macchi *et al.* 2008; Adger *et al.* 2011; Sonwa *et al.* 2012; Vermeulen and Wynter 2014; Barnes and Dove 2015).

Recent years have witnessed a multifaceted debate around the Anthropocene in the social sciences and humanities. The notion has been celebrated for foregrounding human agency in shaping the Earth, thereby introducing humans into natural history (Chakrabarty 2009), and helping to make the case for dismantling the modern divide between nature and culture (Latour 2013a). Taking this celebration further, ecomodernists from the Breakthrough Institute have turned it into a, 'good, or even great, Anthropocene' in which 'humans use their growing social, economic, and technological powers to make life better for people, stabilise the climate, and protect the natural world', (Asafu-Adjaye *et al.* 2015: 6-7). Thus for these ecomodernists the Anthropocene is far from 'final proof of the damage done by techno-industrial hubris' (Hamilton 2015: 233). Other scholars have raised serious concerns with the anti-politics of the Anthropocene (Swyngedouw 2013), arguing that it provides legitimacy to humans' attempted *control* over the rest of the planet (Stirling 2014). My aim in this paper is to build on the critical concerns to propose four aspects of caring engagement between different ways of producing knowledge and artefacts, in order to contribute to defying control that underpins the Anthropocene.

2. The Problem

In its garb of *human* control, the Anthropocene unifies a highly heterogeneous and unequal humanity into a homogeneous Anthropos (Lövbrand *et al.* 2015). Denial of this radical heterogeneity means a failure to take into account the wide variety of resource-exploitation and accumulation (as well as distribution) strategies within and across societies, as well as people's divergent ways of relating with the natural world (Descola and Palsson 1996; Broch-Due and Schroeder 2000; Adams and Mulligan 2003). These divergent ways carry disparate implications for the flourishing of nonhuman species in human vicinity and further afield. A homogeneous Anthropos also ends up ignoring that many people have lived without fossil-fuelled energy, and other modern technologies, during the last few centuries (Malm and Hornborg 2014). The fallacy of a unified 'we' or 'us' of the Anthropos is persuasively challenged by narratives of Marxist and related world-systems scholars who have shown that labour and resources of many humans have been exploited by powerful states and corporations, during centuries of modern colonialism and capitalism (e.g. Wolf 1982; Arrighi and Silver 1999; Foster *et al.* 2010; Moore 2014).

A significant part of humanity, colonised and enslaved, has historically been excluded from (or sharing in any material benefits generated by) modern techno-scientific programmes responsible for large-scale resource extraction and atmospheric emissions. When incorporated as backward peoples into the techno-scientific programmes the non-elite colonised and the enslaved were often subjected to violence and racialisation (Stepan 1982; Blakey 1987; Adas 1989; Baber 1996; Ernst and Harris 1999; Alland 2002; Ordover 2003; Anderson 2004; Douglas and Ballard 2008; Roberts 2011), their bodies and knowledges were seized and translated into modern techno-science (Nandy 1989; Anderson 1992; Philip 1995; Schiebinger 2004; Leckie 2007; Turnbull 2008; Whitt 2009), and some were even treated as guinea pigs, providing the lands and bodies for (engineering, medical and biological) testing and for waste dumping (Gamble 1993; Cox 1998; Kuletz 1998; Macfarlane 2003; Shah 2006; Connelly 2008; Medina-Domenech 2009; Kamat 2014).

Overall, by homogenising diverse humans in the Anthropos, the Anthropocene obscures modern imperial and capitalist control over subjugated peoples and over nature (Mitchell 2002; Merchant 2016). Crucially, a unified Anthropos in charge of the planet also ratifies some powerful actors' efforts to develop planetary control technologies such as climate geoengineering (Stirling 2014; McLaren 2015; Stengers 2015a).

Similarly, by treating different peoples as parts of a homogeneous Anthropos, the Anthropocene implies that responsibility for environmental destruction and recovery rests also with those humans who were either exploited in or did not contribute to this process of destruction. In the context of climate change, many activists and scholars have debated this politics of responsibility (see for example, Agarwal and Narain 1991; Jamieson 1992; Gardiner 2004; Halme 2007; Roberts and Parks 2007; Gardiner *et al.* 2010). My aim in the following is to use the recognition of unequal responsibility to outline aspects of relational transformation of what I call *modernist* practices, particularly those involved in the making of sciences and technologies.

Modernist practices are 'modern', in the sense that they try to perform the separation of nature from culture (Latour 1993). But not all modern practices have to be modernist. As elaborated later, modernist practices are underpinned by the fallacy of control (Stirling 2014: 18). Modernist techno-scientific practitioners, as producers of rational facts, have historically adopted a stance of anti-fetishism toward other supposedly irrational ways of knowing

(Latour 1999a). This anti-fetishism furthers modernist practitioners' confusion of their specific obligations as universal, giving them the freedom to travel to anywhere in the world and disqualify the practices that appear to them as archaic and mythical, or as folkloric illusions (Stengers 2005). Deploying their anti-fetishism, modernist practitioners have been successful in creating a sharp demarcation between their outputs (e.g. facts, modern technologies) and the opinions, emotions, beliefs and illusions produced by other practices (Latour 1999a). The same anti-fetishism helps modernist techno-scientific practitioners distance themselves from the (nonhuman) worlds they investigate, turning the latter into passive objects of knowledge, which should be *controlled* by rational humans to achieve modernist social progress (Mitchell 2002; Stirling 2014; 2016).

The transformation of modernist techno-scientific practices, as developed in this paper, is relational. It goes beyond the modernist practices themselves by treating as central their engagement in and with socio-political institutions and discourses, but particularly with 'other' ways of producing knowledge and making artefacts. Treating the latter ways as static and situated (in their localities), modernists may relegate them to the realm of the indigenous, craft, traditional, local and vernacular (Agrawal 1995; 2002; Kothari 2002; Green 2008; Levine 2014). In urban areas, these other practices may be located at the grassroots or as do it yourself (DIY) (Delgado 2013; Smith and Stirling 2016). Critically, modernists aligned with and informed by 'Science with a capital S' dismiss other ways of knowing/making as irrational, as 'mere remnant[s] of an unenlightened past' (Latour 2001: 217, 218; also see Pignarre and Stengers 2011: 43-44). Practices classified as irrational may include those associated with the religious (Inden 1986; Breitenbach 2008); shamanic (Whitehead 2006; Znamenski 2007); mystical (Urban 2001); magical (Greenwood 2005); 'lay' public and activist (Irwin and Wynne 1996; Ansell 2006; Pignarre and Stengers 2011); or even affective (Grosz 1994; McGrath 2006; Zerilli 2015) practices. In the remainder of this article, taking inspiration from the work on diverse economies (Gibson-Graham 2008), I refer to other ways of knowing collectively, in all their heterogeneity, as *diverse* practices. In encapsulating an uncountable multiplicity of knowing/making practices under the category diverse, I do not imply that this category is in any sense unified, nor do I intend to romanticise or exalt the category in any way (cf. Samers 2005). Instead, I use the category only to point to a whole range of practices that stand apart from modernist practices. The category diverse is thus defined firstly from its outside. Within itself, the category accounts for a heterogeneous plurality of practices. These include especially those that were or are marginalised, disqualified, threatened, or substituted by modernist practices.

I argue that transformation of modernist practices in their engagement with diverse practices of knowing/making is critical for addressing some of the daunting challenges associated with climate change, to build resilience and to facilitate adaptation and mitigation activities (also see Cameron 2012; Head and Gibson 2012; Brugnach and Ingram 2012; Arora-Jonsson 2016). Mine is not just a call for valorisation of 'non-expert' local or indigenous/traditional knowledges. Instead I am calling for the onus of transformation to be primarily placed on modernist (techno-scientific) *practices* that disqualify others.

Specifically, the transformations demand that modernist techno-scientific practices engage with their surroundings differently in two ways. First, modernist practices must offer new terms of inclusion to the human and nonhuman entities that they include as participants in their processes of making (and using) knowledge and artefacts. They must practise care toward (the complexity of) all participants (Merchant 1995; Tuana 1996; Bost 2008; Haraway 2009; Holmberg 2011; Stirling 2015b; Davies *et al.* 2016). By eschewing control, possible harm or exploitation of any entity, they create the conditions for practising precaution (Wynne 1992; Mayer and Stirling 2002; Stirling 2015b). Second, modernist techno-scientific practices

must engage with other practices of knowing/making in ways that do not disqualify them as 'irrational'. Presenting their outputs as universal and transcendent (Stengers 2003; 2005), modernist practices disregard that their making is situated in specific collectives and grant themselves the license to disqualify and eventually substitute diverse ways of knowing/making. Such disqualification and substitution has been central to much state-led development and progress in different parts of the world (see e.g. Gran 1986; Apffel Marglin 1987; Gupta 1989; Long and van der Ploeg 1989; Agrawal 1995; Chambers and Gillespie 2000). Continued disqualification and destruction must be resisted in order to form generative alliances between divergent knowing/making practices for an affirmative climate politics (Head and Gibson 2012; Brugnach and Ingram 2012; Carr and Gibson 2016). A growing diversity of practices may be critical for opening up plural pathways to socio-ecological sustainability (Stirling 2009; Leach *et al.* 2010). To this end, I propose new aspects of *care in engagement* between divergent practices of knowing and making. I write in the hope that, if actualised, the two transformations, to enact caring inclusion and caring engagement, in modernist techno-scientific practices may allow them to 'make kin' not only with new human and nonhuman entities from their surroundings (Haraway 2015), but also with other knowing/making practices in situations of communication and exchange.

Much has been written about the caring inclusion of nonhumans into techno-scientific practices. For example, critical considerations have been offered regarding care for, and companionship with, animals (and the worlds within which they thrive) used in experimental laboratories and beyond (Donovan and Adams 2007; Haraway 2009; Twine 2010; Holmberg 2011; Davies *et al.* 2016; Miele 2016). Additionally caring mutualistic actions, which openly acknowledge the distributed and relational nature of knowing and doing, may afford the inclusion of diverse knowledges and materialities in plural pathways to sustainability (Stirling 2014; 2016). Research has addressed how ideas about a representative or ideal user are translated into technologies, as well as the moral and political questions this raises for the inclusion (and possible adaptations) of new technologies into disparate user contexts and practices (see e.g. Akrich 1992; de Laet and Mol 2000; van Oost 2003; Verbeek 2007; von Schnitzler 2013). In addition, conditions for empowering participation by prospective (marginal) end-users in technology development has been extensively examined (for example Epstein 1996; Biggs and Smith 1998; Schot 2001; Feng 2006; Ornetzeder and Rohracher 2006). In this paper, therefore, instead of digging deeper into issues associated with caring terms of inclusion of human and nonhuman entities in techno-scientific practices, I focus on developing the aspects of care in engagement between divergent knowing/making practices, directing attention to the transformations required of modernist techno-scientific practices to achieve such caring engagement.

3. Practices: Heterogeneous Worlds of Knowing and Making

The focus of this paper is on engagement between practices of (scientific) *knowing and making* (technological) artefacts, rather than on interaction between already made scientific knowledge/technology and other types of knowledge and artefacts. A focus on practices of knowing/making rather than knowledge or artefacts yields a major advantage. Such a focus means that while a discourse, procedure or rule, artefact or fact may be extricated from the practices in which it is produced or assembled, its existence and future possibilities are contingent on and situated in the actual and specific practices of its re-making, repairing, adapting, hesitating and using (Haraway 1991; Akrich 1992; Latour 2005; Graham and Thrift 2007; Stengers 2010a). A focus on practices also means that no entity, fact or artefact, discursive or procedural, comes alone. An entity may be individualised and isolated, but it is always entangled in its relational world, in practice (Callon and Law 1997; Latour 2005; de la Bellacasa 2012).

I view these knowing/making practices as performed by heterogeneous collectives constituted by interrelated human and nonhuman forces (Latour 1988; Callon and Law 1995; 1997), rather than by individual human actors such as scientific and engineering professionals. In fact, such a conceptualisation implies that any individual (human) actors are themselves relationally constituted. Their action is distributed and relational. Humans rely on nonhumans to act, and indeed to survive. Human actions are made possible by a range of interconnected nonhuman forces, constituted by concepts, categories, technical equipment and plants or animals (Latour 2005). In general, there is no Anthropos that can be neatly separated from nonhuman worlds (Pyhtinen and Tamminen 2011).

Scientists and engineers participate in techno-scientific practices, and may attempt to pursue their own goals and intentions that may nevertheless be conditioned by broader economic, political and cultural forces. Human practitioners are guided by their cultural norms and moral values (Giddens 1984), but I consider these norms and values to be immanent to their specific practices, arguing that a practice's constituent values are not societal or universally shared by everyone (Stengers 2010b). Rather, they are situated in a practice, adjusted to work alongside its other constituent (material) forces, even when they are brought into a practice from the outside (e.g. as part of political pressures on how a technology must be developed, or as economists' theories attempting to format actual financial transactions: Mackenzie 2007; Callon 2007).

In addition, different human and nonhuman forces constituting a collective are not equal or coeval. They hang together in asymmetric relations of power, producing differential effects (Latour 1988; Bennet 2010). Some forces in a collective, such as economic values of productive efficiency and profit, may exert greater influence on courses of action and therefore on the knowledge and artefacts produced by the collective. Thus, there are always some, 'whose interests, constraints and demands have been taken into account and all those others who were left outside the arena' (Stengers 2000: 46).

A collective is not to be considered as a sovereign body. It is shaped by flows from/to a surrounding world or *milieu*, also constituted by other practices, within which it survives, thrives or dies. The milieu of any practice is not simply a general environment, as in systems thinking, but rather it refers to the active surroundings specific to a practice, and shaped as an outside by the latter. A practice exists in the middle of its milieu and vice versa (Stengers 2005). In this way, a collective that performs a practice and its milieu are co-constitutive. It is

the relations between human and nonhumans forces in a collective and with its milieu together that make a particular course of action (as practice) possible.

The foregoing conceptualisation of practices treats knowing/making as relational processes (Latour 1988; 1996; Stirling 2016). In this conceptualisation, objects of (scientific) enquiry are not already out there in some natural form, waiting to be discovered by human subjects possessing the requisite expertise. Instead what is known about anything emerges out of relations formed between subject(s) and object(s), within heterogeneous collectives that perform acts of knowing. An object of knowing may be individualised as a *known fact*, ex-post by science, but in the *knowing act* it is relationally entangled with other entities in a heterogeneous collective and its surroundings. Thus, knowing is 'constituted by [relational] doing', but not all action is 'predicated on knowing' (Stirling 2014: 19). It is thus useful to think of practices as relational 'knowing doings' (Stirling 2016), also when they are geared toward making, repairing and using material artefacts. Thus knowing may be concomitant (but not prior) to all practices, often through learning and skilling (Lave and Wenger 1991; Stone 2004).

Crucially, relational entanglements in knowing acts or knowing doings tie human practitioners in the collectives to specific obligations and requirements, which are mutually constitutive (Stengers 2010b). *Obligations* are directed by a group of practitioners toward their colleagues. They might manifest as rules to guide how the enactment of a knowing act should be presented to colleagues, and other audience or observers. In the experimental sciences, the obligations may demand that scientific practitioners reveal how they have actively re-composed the phenomenon being investigated, using a laboratory apparatus, to be able to speak in that (real) phenomenon's name using the experimental setup and facts as reliable witnesses. This power of a matter of fact to work as a reliable witness, 'capable of making a difference among those who interpret it', depends in turn on the *requirements* that the particular phenomenon under investigation is subjected to (Stengers 2010b: 50). These requirements, in order to be satisfied, may demand that the phenomenon be 'isolated and purified' inside the laboratory (ibid.; also see Latour 1988).

Obligations and requirements of a practice are mutually constitutive. Obligations may bind a scientific practitioner to describe the different requirements of their practice in a particular format. In turn, requirements of a practice provide the specific material transformations to be interpreted and described, thereby helping practitioners meet their obligations to colleagues. Overall, any entity or phenomenon under scientific investigation does not refer to an autonomous and objective Nature, as distinct and removed from humans. Instead, scientific practitioners describe the phenomenon as reconstructed inside a laboratory or in the form of a computer simulation. Thus it is the practitioner's specific translation and re-composition of some material aspects of the natural world, towards which the practice's requirements are directed. This re-composition, with its concomitant requirements, is shaped by the obligations of a specific practice. For example, if the obligations of a practitioner (towards her colleagues) stipulate that no mutilation of any participant in the practice is permitted, then only nonviolent and caring requirements may be directed toward the material world re-composed for investigation.

Due to its unique identification with 'the imperatives of rationality and objectivity' (Stengers 2000: 42) science is considered to be unlike any other practice. However, treating science in the singular, as a unique practice, leads to an essentialisation of the highly heterogeneous range of practices that are carried out in the name of science. Even within a single setting, such as a hospital, for diagnosing a single disease, such as atherosclerosis, clinical practices are significantly different from those enacted in the laboratory (Mol 2002). It is thus more appropriate to approach science in the plural, as *sciences* practised by and situated in different

heterogeneous collectives. Appreciating the sciences as practices that are, like other practices, performed by heterogeneous collectives is not to deny distinctiveness. In fact, by appreciating a specific techno-scientific practice, with its own obligations and requirements, one is able to grasp exactly how it might have realised its achievements and so how it might be distinctive (Stengers 2000). It may also be possible to grasp the degree to which different sciences are influenced by the imperatives of capital (investors) and the obligations associated with extensive inter-firm contracts. To treat all sciences as uniquely rational, neutral and objective, is to ignore their diversity and the substantial influence of political-social-economic factors in what some scientists produce and how they produce it.

The recognition of sciences as practices that come in different shapes and sizes allows me to delineate what I refer to as modernist scientific (and technological) practices. In the next section I briefly re-turn to the notion of the Anthropocene, in order to outline what I mean by modernist techno-scientific practices and my concerns with them.

4. Modernist Techno-scientific Practices

Crucial in the Anthropocene notion is the role that is afforded to humans, as unified in the *Anthropos*, in relation to multiple disparate nonhuman worlds. It is in this way that the Anthropocene, by definition, ascribe to humans the power to exercise *control* over the rest of the planet (Stirling 2014). Additionally, as discussed earlier, by emphasising the force of a 'notionally homogeneous' humanity in reshaping the planet, the notion of the Anthropocene actually helps extend this control (Stirling 2015a). Thus, in Stirling's argument, the Anthropocene notion does not, as Latour has argued, help to transcend the 'modern constitution' that separated humans and nonhumans, but instead it discursively helps to entrench the power of those humans supposedly possessing the right expertise and capital, to push their dreams of planetary control on our collective present and futures (Stirling 2014).

Building on this argument, I consider attempted control to be a core ethos of what I call modernist practices of knowing and making, in science and technology (Mitchell 2002). Certainly, not all modern scientific and technological practices have to be underpinned by control. And crucially for my arguments in this paper, even practices I call modernist can undergo transformation to become constituted by values of humility, care and trust toward others, rather than by the 'fallacy of control' based on a grandiose belief in (some knowledgeable) humans' unilateral ability to apprehend and bring about complex change (Stirling 2014: 18; Lidström *et al.* 2015: 4). This belief becomes widespread and entrenched, as agency for bringing about socio-technical change is attributed to or appropriated by modernist experts and state officials. Such appropriation of agency marginalises the distributed performance of practices by assemblages of interrelated human and nonhuman forces, which I have termed heterogeneous collectives. And in this way, any contingency and uncertainty associated with the performance and unfolding of situated practices is also marginalised (Latour 2005; Stirling 2014).

The heterogeneous collectives that perform modernist practices are constituted by specific kinds of connections that attempt to exercise control, on nonhumans (and marginalised humans) within the collectives and over their milieus. In some scenarios, such as those where animals are subjected to cruel tests, some entities participating in a modernist knowing/making collective, or in its milieu, may be humiliated and mutilated. In general, modernist practitioners fail 'to take into account what their subjects feel and think'. (Stengers 2000: 52). In their quest for objectivity or scientific rigour, they might 'put rats into boxes or students into statistics', asking us to 'bow down, *a priori*, before the empty power of figures' (Stengers 2000: 43-44). Modernist practices do not aim to account for, and preserve or allow to proliferate, diversity in a population or sample of their human and nonhuman objects of knowing (e.g. species, a social group). They attempt to control deviation in a group of subjects under investigation, often reducing deviation to the status of a statistical outlier. In general, in constructing modernist scientific propositions, they may try to suppress the recalcitrance of different objects of knowing (Stengers 1997) by treating these objects as passive and compliant (Latour 2000; 2004). This suppression, in turn, paves the way for the treatment of nature as separated and distanced from humanity. Nature here plays the role of a backdrop and a resource, to be controlled and disposed of as desired by Man, for the flourishing of (a particular) human culture (Haraway 1991).

Crucially, modernist scientific practitioners mistake their specific obligations for universal ones. By doing so, they feel 'free to go everywhere, to enter any practical territory, to judge, deconstruct or disqualify what appears to them as illusions or folkloric beliefs and claims' (Stengers 2005: 191). Believing firmly in the general validity of their scientific truth, and

forgetting how it might be contingent on its own heterogeneous collective and its milieu, including so-called social factors such as persuasion (of colleagues), specific values and norms, modernist practices of knowing also end up marginalising the uncertainties that are inherent to knowing and embedded in its outputs. These uncertainties are distinct from risk that is calculable based on an event's probable occurrence (Callon *et al.* 2009). Under uncertainty, possible (future) states of the world are unknown (Knight 1964). Additionally, causal chains may not be fully identifiable and outcomes may be difficult to predict (Wynne 1992).

Similarly, modernist technological practices obscure the uncertainties in the associated scientific knowledge and inherent to the operation of their artefacts. Instead these practices emphasise the precision and perfection of artefacts such as nuclear missiles (Mackenzie 1990), and solar kits (Akrich 1992). Modernist technological practices, with their constitutive mathematical models and engineering standards, are also constituted by universalist ethos. They are underpinned by the belief that once important technical problems have been solved, and once the technologies have been proven to work in design and production settings, they should be yield the same results as long as the operating conditions are replicated in user settings (Akrich 1992; Hyysalo 2006; Winance 2014). Ultimately, as outlined above, modernist technological practices are underpinned by an ethos of control, attempting to exercise it not only on disparate user settings but also on the entities included in the heterogeneous collectives (and their milieus) that perform these practices. The question animating the remainder of this article asks what would practices of knowing/making look like in terms of the constitution of their heterogeneous collectives and their relationships with their milieus, if they are not underpinned by control.

5. Minoritarian Practices

To conceptualise the transformation of modernist practices of knowing and making, in scientific and technological programmes, I propose the notion of minoritarian practices. The latter are not simply the knowing/making practices of a particular minority social group (cf. Parekh 1996). The notion minoritarian, and by association the term minority, as used here, is not quantitative (Deleuze and Guattari 1987: 105). Instead minoritarian practices refer to any acts of knowing and of making/using artefacts, which are constituted by 'a new style of concern, demanding that the dream of control or mastery be given up, replaced by the need to pay attention to, to *care* about and to learn from what we are bound to coexist with' (Stengers 2015a: 137). Also, minoritarian practices are not the same as practices classified as vernacular, indigenous or traditional. The latter are generally treated as situated outside the realm of 'modernity'. Instead minoritarian practices may be enacted and achieved anywhere, including at the heart of Western modernity as well as in societies considered non-modern or described as alternative and multiple modernities (Eisenstadt 2000; Gaonkar 2001). Crucially, a minoritarian practice does not necessarily have to be already found as existing out there. Instead the concept minoritarian practice, as used here, points to the transformations that modernist and any other practices have to undergo, in order to become underpinned by relations of care.

In the first place, care implies that minoritarian (scientific and other) practices account for heterogeneity and deviation within any category such as species or social groups, deemed to constitute Nature or Society. In addition, minoritarian practices do not identify with a standard model or measure. They do not present their products, the fruits of their labour, as prerequisites (e.g. ideas, discourses, technologies) for all others to follow and build upon. Thus, by not providing standard models for others to follow or live up to, by not identifying with a techno-scientific frontier that others can catch up to, minoritarian practices present themselves as non-normal. However, their deviation from the normal is not provided by disqualification of accepted wisdoms associated with religious practices and with diverse practices classified as vernacular, indigenous or traditional. If a non-normal practice succumbs to the temptation of disqualifying any diverse practices, it would undermine its minoritarian becoming and risk joining the pantheon of modernist practices.

Secondly, minoritarian practices admit uncertainty, ambiguity, fragility and ignorance associated with their actions and outputs (Stirling 2015b). In other words, they admit the partiality, and contingency, of their own knowing and making (Haraway 1991). Thus, they present themselves in and to the world not from the vantage point of the completeness of their knowledge or of the perfection of their artefacts (for all users with the requisite skills), but from a position of humility. It is by obscuring their partiality, contingency, situatedness, fragility, uncertainty, ambiguity or ignorance that modernist knowing/making practices are able to present themselves as complete. However, in the natural and social sciences, colleagues are not generally persuaded because a specific account of some phenomenon is complete, or even because the particular scientist forwarding the account is highly influential. Instead what may persuade colleagues is 'their own incapacity to offer another interpretation' (Stengers 2000: 47), as well as to their inability to assemble the same heterogeneous collective (constituted by skilled personnel and technologies) as the one on the basis of which the original interpretation was forwarded. Overall, minoritarian practices deploy incompleteness, uncertainty and ambiguity as 'technologies of humility' (Jasanoff 2003), particularly in their engagement with others (as discussed in the following section).

Third, minoritarian practices nurture the fluid adaptability of their outputs by those considered as users, allowing the latter to adjust the facts and artefacts into their own settings (Law and Mol 2001). The adjustments allow the so-called users, situated in their own collectives, to ensure that the artefacts are workable using locally available tools and other resources (de Laet and Mol 2000). In this way, users in their own settings are able to learn contextually, developing the practical skills necessary to care for and re-design the artifacts they use. This gives rise simultaneously to a multiplicity of locally-adjusted artefacts and differently skilled users, engendering a diversity of heterogeneous collectives, each with their own immanent values (Fatimah and Arora 2016).

Fourth, minoritarian practices strive to cultivate multiform relations in their heterogeneous collectives and with their milieus (as proposed below). Acknowledging that different human and nonhuman forces may be related with each other differently, multiform relations continually guard themselves against: a) pressures to develop relations that direct and control others; and b) standardisation of ways of relating. Resisting the latter standardisation is based on the recognition that a diversity of relations between entities may be critical for the production of new knowledge and artefacts in a heterogeneous collective. Also, contingent on different ways of relating in heterogeneous collectives in the global South and North, multiform relations address and nurture the co-existence and thriving of multiple divergent ways of knowing and making (Law 2015; Arora-Jonsson 2016; Zanotti and Palomino-Schalscha 2016).

Furthermore, minoritarian practices do not aggressively extend their boundaries. In situations where they do stretch their boundaries, through contact initiated by an entity interested in inclusion into their heterogeneous collectives, minoritarian practices are non-assimilationist. This implies that they strive to maintain the difference and recalcitrance of the newly included entities (Stengers 1997; Latour 2004). In this way, they allow a new entity to introduce perplexity into the minoritarian practice (Latour 2004), leading to a process of rethinking and recomposing knowledge propositions and artefact constructions. Critically, if the entity being included has been historically marginalised, subordinated or silenced, then emancipatory terms of inclusion will imply that it must be habilitated into the collective that performs the practice, rather than being offered a prosthesis to bring it up to a fitness considered strong enough for inclusion into the collective (Callon 2008). Habilitating an entity into a heterogeneous collective of a minoritarian practice, requires carefully configured transformations of the collective in order for the new marginal entity to express its difference and to further its dissent upon inclusion. It also implies that, upon inclusion, the entity is allowed to cultivate redemptive rather than morbid ties with other entities in the collective (Latour 1999a).

In order to be present as minoritarian, significant transformations will be required of modernist practices. These minoritarian becomings of modernist practices must be enacted relationally, which implies that the transformations will have to be carried out in engagement with a milieu that includes other practices. To guide these transformations, I propose four conceptual aspects of caring in engagements between (minoritarian) practices of knowing/making:

- *egalitarian commitment* to sharing epistemological authority among different practices;
- *ontological sensitivity* by letting others define their own 'bases' of knowing/making;
- *nonsubsumptive learning* from other practices; and
- *affinity in alterity*, cultivated for sustaining and growing the space of difference between practices.

By enacting such caring engagement, I hope that divergent practices will be able to achieve their minoritarian becoming. This process of becoming will allow them to circumvent historical confrontations in which the modernists (presenting themselves as uniquely rational and scientific) disqualify and help destroy practices treated as irrational (e.g. shamanic, ideological, magical, religious, or affective).

6. Care in Engagement

In order to approach the challenges of climate change with care, to defy the fallacy of control inherent to the anthropocene, I argue that the trust historically placed in the certainty (accuracy) of modern techno-scientific knowledge (artefacts) be distributed, by recognising that all knowing/making practices carry the potential to produce valid knowledge and working artefacts. In this way, trust needs to be pluralised and proliferated, among minoritarian practices that admit uncertainty and fragility of their facts and artefacts, rather than eroded or replaced by suspicion and disqualification (Latour 2013b). Such pluralised trust can also then afford an exploration of complementarity between divergent minoritarian knowing/makings.

This distributed plural trust is central to the first of the four aspects of care in mutual engagement proposed below, for relational transformation of modernist techno-scientific practices.

6.1. Egalitarian commitment to sharing authority

By presenting their facts and technologies as neutral, value-free and objective, modernist experts have framed their objects of knowing – social and natural phenomena – to be the same or similar everywhere (Mitchell 2002). Taking this as given, universalist remedies in the form of modern artefacts or the application of strategies based on scientific laws, are stated to be not only adequate but also superior to diverse other ways of knowing for addressing these problems. In this way, not only is the power of so-called universal reason deployed to control nature but also social organisation is altered as other ways of knowing and making are replaced by modernist sciences and technologies. This alteration of social organisation is also at the same time material, as modern artefacts are introduced and adopted, and as natural beings are altered, in and around modernising heterogeneous collectives. Similarly, modernist social sciences such as economics similarly produce systematising knowledge that attempts to uncover the 'rationality of social life in ideal form' (Mitchell 2002: 1). Finding deviations from this ideal form in specific settings, and treating them, for example, as market imperfections, modernist social scientists help design policy and planning interventions to ameliorate or remove the deviations. In this way, they attempt to extend the ideal rationality they have identified.

These issues are well-documented. Studies have, for example, shown how neoclassical market designs displace other ways of organising the economy (Elyachar 2005; Mitchell 2007; 2009). In development studies, many have shown how farmers' knowledge or local health workers' skills are marginalised in encounters with so-called modern techno-scientific knowledge and artefacts (see for example Gran 1986; Apffel Marglin 1987; Gupta 1989; Pigg 1995; Bhutani 2013). In response to this marginalisation, many scholars and practitioners in international development made calls, and helped design interventions, for valorising diverse knowledges that were characterised as local, people's, indigenous or traditional (Richards 1985; Warren 1991; Pigg 1995; Blaikie *et al.* 1997). Some of this valorisation took the form of participatory research and technology development (Farrington 1988; Bentley 1994; Biggs and Smith 1998; Uphoff 2002). However, often these valorisations, and the development interventions organised to put them into practice, ended up romanticising the capacity of supposed beneficiaries, their (poor) communities and their knowledge. In this way, they often ended up obscuring unequal power relations within beneficiary communities as well as between techno-scientific experts and other diverse practitioners (Thompson and Scoones 1994; Mosse 2001; Gururani 2002; Briggs and Sharp 2004; Arora and Romijn 2012).

I propose to address the same problem of marginalisation of some ways of knowing and making artefacts. However, as noted above, the thrust of my argument is not directed toward re-valourising any non-expert local or people's knowledge. Instead I emphasise the need of and responsibility for transformation in what I described above as modernist knowing/making *practices* that disqualify others. It is the modernist techno-scientific practices that need committing to sharing epistemological authority, equally, in (participatory) encounters with those practices that they may consider as static or irrational.

The crucial matter to take into account is that encounters between practices are socio-material, involving heterogeneous collectives of humans and nonhumans, rather than simply interactions between individual actors. Individual practitioners enter any encounter while being tied to their own obligations and requirements. This implies that egalitarian commitment to sharing epistemological authority by modernist practitioners requires more than their individual will, or transformed self, in order to trust other individuals' ability to produce valid knowledge and artefacts. In the case of modernist practices, any individual will to transform and share authority will be constrained by the practitioners approaching their obligations as universal. Additionally, modernist practices' commitment to sharing epistemological authority may be constrained by a lack of recognition/representation of the ontological multiplicity of things (Mol 2002: 164). Mol has demonstrated this for atherosclerosis in a Dutch hospital. Atherosclerosis is enacted in multiple ways: as constriction of arteries in the pathologists' laboratory, as pain in the limb of a patient in the clinic (and in the patient's home), and as the loss of lumen in blood vessels in the radiologists' x-rays. Thus, far from being a singular disease, as it is presented in individual publications that marginalise the fluidity and partiality of scientific knowing, atherosclerosis is ontologically multiple.

Recognising the ontological multiplicity of any entity paves the way for appreciating the validity of different ways of knowing and making artefacts, modern and non-modern. Some aspects of an object of knowing, or an artefact in use, may be actualised by 'tying knots' between it and other elements of a heterogeneous collective (including the whoever is presented as the knowing subject and the user) (cf. Serres 1997: 20). These knots point to minor or major transformations that any entity goes through as it is entangled into a heterogeneous collective. Now, when the constituent elements of the heterogeneous collective are different, or when the knots tied are of another type, the same entity may be made manifest in a different way. By recognising that the knowing and making of any individualised entity is situated in a specifically knotted collective composed of humans and nonhumans (Mol 2002), and that entities change over time in/as dynamic processes (Whitehead 1978), minoritarian techno-scientific practitioners may be able to attain and sustain their egalitarian commitment to sharing epistemological authority with other (minoritarian) knowing-making practices.

6.2. Ontological sensitivity

Engaging with other (minoritarian) practices implies taking their 'ontological self-determination' seriously (Viveiros de Castro 2003: 3; Candea 2011). This second aspect of (building) caring engagement requires that notions associated with diverse practices be treated as philosophical *concepts* that are charged with their own distinctive meanings (Viveiros de Castro 2003; 2013). This means that, rather than treating the latter notions as particular manifestations of *a priori* defined concepts such as cognition or kinship, and rather than explaining them in terms of a transcendent political or economic context of class or capitalism, they should be treated as having been constructed and sustained on their own relational 'preconceptual ground' and material reality (Viveiros de Castro 2013: 484). In the

terms of the present paper, the latter may be the heterogeneous collective *and* its milieu, to which a particular concept is immanent.

Recognising disparate notions associated with diverse practices as concepts foregrounds that the world described by them is *ontologically different* (ibid.), rather than implying a psychological or cognitive difference in thinking and describing. Thus, others' thought does not present a particular version of transcendent 'universal processes of human cognition', nor is it an 'expression of a particular cultural world' (Viveiros de Castro 2013: 489). Rather it points to unbounded ontological pluralism. The latter goes beyond the multiplicity of the 'same' entity such as atherosclerosis discussed above. Such ontological pluralism begins by 'accepting alterity and equivocation as 'unsubsumable' by any transcendent point of view' (Viveiros de Castro 2015: 9). This leads to a continual opening up to multiple possible natures, rather than a single Nature that is understood and represented in diverse ways across different cultures (see Stirling 2007 on opening up and Viveiros de Castro 2012 on multinaturalism).

Furthermore, a philosophical concept is not a belief system or a representation, nor is it a (social) scientific proposition that links together dependent and independent variables (Deleuze and Guattari 1994: 22), but rather it carries within it a 'properly philosophical significance' comparable to Leibniz's *monad* or Descartes' *cogito* (Viveiros de Castro 2013: 485; 2003). This philosophical significance is vastly different from the one of the technosciences based on chains of reference and relationships between constants and variables (Latour 1999b; Deleuze and Guattari 1994). Even though the scientific chains of reference and the philosophical significance of a concept both possess a history, and both are formed of multiple disparate elements, the concept is defined by its consistency (Deleuze and Guattari 1994: 19-20). Inherent to this consistency is the 'holding together' of the disparate elements in connection with each other, which makes collective creativity possible, while making sure that the disparate elements can be distinguished from each other (Deleuze and Guattari 1987: 323, 329, 344). Thus a concept's elements 'are distinct, heterogeneous, and yet not separable. The point is that each partially overlaps, has a zone of neighbourhood [*zone de voisinage*], or a threshold of indiscernibility, with another one' (Deleuze and Guattari 1994: 19). Overall then a concept's elements cannot be neatly separated like the dependent and independent variables or constants of scientific propositions. They are 'neither constants nor variables but pure and simple variations ordered according to their neighbourhood. They are processual, modular' (ibid.: 20).

By treating diverse practices as concepts, ontological sensitivity points to the importance of resisting the temptation to evaluate and explain the reality and objects of inquiry that drive and sustain them. Ontological sensitivity embodies a refusal to treat other practices as different cultural ways of examining generic problems associated with a single Nature (Viveiros de Castro 2003). It requires approaching other practices without assuming beforehand what problems they might pose and what objects of inquiry they might find relevant. In addition, it requires refraining from using one's own criteria to evaluate the results of others' inquiry, 'refraining from either assent or critique, allowing the people [other practitioners] themselves to specify the conditions under which what they say is to be taken' (Candea 2011: 147). These conditions of knowing, of forming concepts, in heterogeneous collectives and their milieus, may appear artificial or special to an outsider. But, it is important to not measure or evaluate. It is important to *slow down the desire to explicate* the worlds of diverse knowing/making practices, to not readily resolve their knowledges into truths and falsehoods, facts or fantasies, and their artefacts into medical feats and charlatanistic frauds (Stengers 2003).

While recognising that other practices can only be engaged with seriously in relation to one's own practice, with its constituent terms, materials, obligations and requirements, slowing down resists making explicit the worlds of others' practices. Keeping the others' worlds implicit means that attempts are not made to actualise the possibilities of their thought in one's own practice. Overall, rather than being used as a tool for facilitating the (incomplete) explication or mystification of others, this implicit appreciation may be used to make one wonder about one's own practice, in order to multiply the world (within and without its heterogeneous collective) that sustains one's own practice (Viveiros de Castro 2013: 491-92).

6.3. Nonsubsumptive learning

In encounters and engagement between different practices, minoritarian practices may find some implicit aspects of other practices interesting for extending one's own practice. Even in encounters where one of the practices is deemed inferior, modernist practitioners may nevertheless try to learn from this inferior practice. Studies have shown how this learning may be used to provide and accumulate inputs for further systematisation of, or filling in so-called implementation or application gaps associated with, a dominating practice (Latour 1987: 215-32; Whitt 1998; Agrawal 1999; Heckler 2007; Bohensky and Maru 2011; Rist *et al.* 2016; Toomey *et al.* 2016). Other scholars have argued that learning by the powerful may be used to appropriate and exploit local people's medicinal or agrarian resources and knowledges, to further capitalist accumulation or to legitimise development interventions (Shiva 1988, Pigg 1995; Marden 1999; Mooney 2000; Mosse 2001; Hawthorne 2007). In some cases of appropriation, e.g. bioprospecting, the UN's convention on biological diversity (CBD) stipulates that corporations must share economic benefits with the original owners of these resources such as indigenous communities in the global south (see for example Hayden 2007; Vermeylen and Walker 2011). However, indigenous activists and scholars have raised the issue as to whether economic benefits can be considered adequate compensation if rising (international) demand for a product makes it inaccessible to people who have historically produced and used it (see for example Blythman 2013; Kerksen 2015 on Quinoa), or whether it leads to local resource scarcity and deforestation (Siddique 2016; AFP 2016). Similarly, increased globalised demand for a product may also contribute to a dramatic reconfiguration of its production/use practices, and in the product itself, for instance through the development of patented high-yielding seeds rather than seed saving and exchange by farmers (IAASTD 2009; Tripp *et al.* 2010; De Schutter 2011; Bhutani 2013), through standardised monocultures rather than sustainable polyculturing (Glass and Thurston 1978; Shiva 1988; Mol 2007; Arora *et al.* 2013; Dawson *et al.* 2016), or through certification based on surveillance and control rather than on trust and relationship building with small farmers and their worlds (Tovar *et al.* 2005; Friedberg 2007; Hatanaka and Busch 2008; Arora *et al.* 2013).

Additionally, governments, firms and international development agencies (such as the World Bank) may promote agricultural research and cultivation of specific crops (for example soy, cocoa, avocado) and seed varieties (for example long grain rice, wine grapes), for export markets, which may divert resources away from other types of (staple) crops and medicinal plants that were previously harvested and developed (Bowring 2003; Akram-Lodhi 2008; Food & Water Watch 2008; De Schutter 2011). Any of the above may lead to non-learning in and eventual non-use of farmers' cultivating and knowing practices, as well as of people's eating and healing practices. In some instances, if people do not practice their knowing and making, *in situ*, their knowledge and artefacts end up existing only in *ex situ* archives as static resources for modernist techno-scientists to tap into (Agrawal 1995; 2002; Whitt 1998). In other situations, the appropriated knowledge and artefacts may thrive in active production and use inside the factories (and plantations) of the modern corporation that exploits them, often

while propounding their benefits for a unified humanity's health and the natural world (ten Kate and Laird 1999; Langton 2003; Parry 2004). Clearly, learning from diverse practices by authoritative techno-scientific experts and by powerful corporations is widespread. This learning, as documented above, is often performed as a modernist practice underpinned by appropriation from, and possible discontinuation of, diverse practices. For this learning to become minoritarian, it must be transformed to become nonsubsumptive.

Nonsubsumptive learning encounters do not make the sustenance of other practices more precarious. In such learning encounters, any techno-scientific practices do not attempt to subsume other practices they encounter, by converging them and blending with them to constitute a single homogeneous we or us (Stengers 2010b). In other words, such learning encounters further divergence of the engaging practices from each other. The sustenance of divergence may indeed keep the engaging practices different, providing the conditions for future learning encounters between the practices. Learning may thus be contingent on sustaining divergences. Engagements between practices must take the 'manner of making divergences exist, of naming and taking them into account' (Stengers 2015b: 141). By taking divergences into account and by proliferating them, it may become possible to produce *de jure* equality between multiple knowing/making practices. Such equality is constituted by struggles against epistemological advantage of modernist techno-scientific practitioners, and lays the foundation for achieving care and trust in engagements between divergent minoritarian practices. In this way, a richer overall diversity of practices may be continually cultured and nurtured (Stirling 2011), particularly in situations where capitalist forces attempt to extend the logic of fast and indiscriminate accumulation.

Another dimension of nonsubsumptive learning relates to the development of different minoritarian practices' capacity to distinguish between good and bad engagements or encounters between practices (Stengers 2008). In good encounters minoritarian practices allow each other to detect and value how their practice is distinctive in terms of the constituent components in its heterogeneous collective and its regenerative actions. Good encounters ensure that this distinctiveness, or difference from other practices, is not diminished. As with other aspects of care outlined in this article, the capacity to discern good encounters is contingent on the specific situation of exchange, on the relational reality of a specific encounter. This implies that, once triggered and then continually nurtured in different encounters, there is no guarantee that this capacity to discern will always lead to the predictable outcome of avoidance of bad encounters. In addition to being contingent on the milieu of a practice, and the intensity of power asymmetries at play in actual encounters, this capacity may need to be complemented with the enactment of the second aspect of care in engagement, i.e. sensitivity toward other practices' ontological difference and self-determination, as discussed above.

6.4. Affinity in alterity

My fourth aspect of care in engagement between minoritarian practices relates to affinity across widening divergence. The standard dictionary definition of affinity claims that it refers to 'natural liking for someone or something', underpinned by 'a similarity of characteristics' (OED 2016). However, if etymological roots of affinity are followed attentively, in the combination of *ad-* or to and *finis* or border, it may be reinterpreted as developing a liking from the vantage point offered by the margin of where one is located. If this location happens to be the heterogeneous collective that performs a practice, a marginal practitioner is not only able to feel her own obligations and requirements but is also able to sense the other outside her collective (cf. hooks 1989). From the margin, a practitioner is thus able to discern otherness (difference, variations) in the milieu and within her own collective. This

simultaneous discernment and recognition of the other, from within and without, may help to transform a practitioner's obligations and requirements from outside one's practice. In this way, otherness may be taken into consideration by the practitioner's collective as one of its constitutive foundations.

Additionally, considering the processual nature of heterogeneous collectives, as discussed above, any difference if named and sustained is akin to *divergence*. Then, for enacting care that proliferates diversity, from the margin, a practitioner develops affinity not just on the basis of resemblance or commonality of characteristics, but also on an appreciation of widening divergence. This appreciation for widening divergence then points not only to tolerance and respect, or even love, for the other but also to the active work involved in seeing and growing the relational space of incommensurability between two or more divergent practices.

The foregoing does not just point to developing an 'affinity with the enemy' (Deleuze and Guattari 1994: 203). Rather it is about resisting the treatment of all difference and divergence as (dialectical) opposition in order to circumvent modernist confrontations between practices. But this cultivation of affinity with other practices near and far, across divergence, can be difficult if affinity is built primarily on categories that encapsulate entities deemed similar (for example species in biology, social groups in sociology, identities in cultural studies). The latter type of affinity founded on shared membership of a category is routinely enacted by modern techno-scientific practitioners. This means that the possibilities of enacting affinity in alterity may be rather small for modernist practitioners, as well as because any observation of alterity by modernists may lead to encounters in which hierarchy between different ways of knowing is affirmed. This has two implications for caring engagement. First, as discussed in the previous section on learning, when (modernist) practitioners encounter difference and indeed divergence, they do not view the other as inferior and thus they do not attempt to transform the other into a version of themselves (see Corbridge 2007, for this dialectic of difference and sameness in international development). Instead, practitioners develop an affinity with divergent others in and of themselves.

Second, caring engagement demands that practitioners use their own belonging to a specific group or category reflexively, recognising that they have gained the authority to speak by belonging to their own group of practitioners. Then, affinity with others is to be treated as 'a question of group-to-group relationship' (Stengers 2011: 336). The group identity (and authoritative knowledge) of a practitioner is not only the basis of her engagement with others, but also an effect of the relationship with the other. In this way, one's own identity as a practitioner is understood as ecological. Its closure around a group of practitioners, and the transmission of this closure serves as a 'condition of exchange' with other groups of practitioners. However, as Stengers notes, there can be no general theory of this practical exchange:

Each mode of closure and transmission constitutes a unique solution that creates its own constraints, problems, requirements, and obligations in terms of exchange [as a practice]. In short, it creates the practical identity of what is called 'exchange'.
(Stengers 2011: 337)

If the four aspects of caring engagement I have outlined here are to constitute possible obligations and requirements in the practice of exchange between minoritarian practices, they must be treated as abstractions rather than as theoretical generalisations that work the same way everywhere. As abstractions, I hope that they will be able to find renewed relevance

in different inter-practical exchange settings which are not yet materialised (Stengers 2011: 327).

7. Conclusion

In recent debates, the Anthropocene notion is praised for potentially dismantling the modern dualism between nature and culture (Latour 2013a). It is also argued that the Anthropocene reproduces the same modernist separation of nonhuman matter from human agency (Pellizzoni 2016). Within this debate, however, there seems to be substantial agreement that humans must urgently bear the responsibility to address climate change and to reduce their geological impact. Calls are thus made for 'planetary stewardship' (Steffen *et al.* 2011; Schmidt *et al.* 2016), and for 'more effective Earth system governance' (Biermann *et al.* 2012: 1306). The latter governance understandings frequently further the fallacy of control by assuming that knowledge comes prior to action, uncertainties inherent to knowing can be eradicated with more (integrated) knowledge, and formal procedures are adequate for achieving desired outcomes (Stirling 2014: 7; Hulme 2015; Stirling 2016). Some framings of stewardship are similarly control-driven, with humans unified into a single 'we' who (scientifically) know 'how our activities influence the Earth system' and, due to this knowledge, have 'the power and the responsibility to change our relationship with the planet' (Steffen *et al.* 2011: 749). Planetary control technologies such as geoengineering are also included under stewardship in such framings. These framings thus resonate with the techno-utopian vision of the ecomodernists at the Breakthrough Institute (see Asafu-Adjaye *et al.* 2015).

Alternate interpretations of stewardship have attempted to move away from control narratives of the Anthropocene. For example, recognising the heterogeneity of socioecological processes on the planet which also produces injustice and inequality, Ogden *et al.* (2013: 346) make the case for a stewardship that is not 'simply about human beings finding a technological or normative fix that will control and restore the Earth' (quoting Gibson-Graham and Roelvink 2009: 322). Similarly, Schmidt *et al.* (2016: 8) call for an ethical stewardship that takes uncertainty seriously, while admitting that there are 'many legitimate histories and forms of knowledge production that arise from diverse cultures the world over' (Schmidt *et al.* 2016: 8). Lorimer (2015: 4) argues that the Anthropocene 'has the potential to value and catalyse modes of "stewardship" based on diverse, reflexive awareness of the always-entangled nature of humans with their environments'.

These diverse interpretations of stewardship mean that the notion Anthropocene itself does not embed a precise conceptualisation of, or implication for, how planetary stewardship (or governance) is to be enacted (Pellizzoni 2016). Yet, the notion Anthropocene nevertheless legitimises a historical narrative of human shaping of and control over the planet (Stirling 2014). It does so by englobing diverse humans within a unitary *Anthropos*, by separating the surrounding nonhuman worlds that humans are inextricably bound with, and by giving humans the power of being a geological epoch-defining force. This appropriation of planetary agency for humans marginalises various (recalcitrant and overexploited) forces of nature. It also overlooks alternate cultural-natural pathways of being and becoming in/of the world. In this way it emboldens powerful incumbent interests to further their techno-fixes of planetary control.

In order to defy this control embedded in the Anthropocene (Stirling 2014), and to contribute to addressing the challenges of climate change while taking historical difference (and future divergence) into account, I have argued that modernist techno-scientific practices bear a responsibility to transform themselves. This transformation means that modernist practices work toward minoritarian becoming, in and through caring engagement with diverse knowing/making practices. This caring engagement may be crucial for sustaining divergences between practices. It may also be critical for expanding the overall diversity of practices, by

creating space for new innovative practices to emerge, each immanent to its own heterogeneous collective. Such expanding diversity of knowing/making practices may then be constitutive of unbounded *ontological pluralism*. Caring engagement creates space for collaborative action by divergent minoritarian practices, while taking into account issues of unequal power relations, historical responsibility and injustice. Overall, moves toward caring engagement between minoritarian practices may be critical for transforming social progress: to realise alternatives to the natural-cultural violence unleashed by globalizing entrepreneurs seeking endless Schumpeterian creative destruction and modernist standardisation.

In order to circumvent control, I have outlined four aspects of caring engagement: egalitarian commitment; ontological sensitivity; nonsubsumptive learning; and affinity in alterity. I do not offer these aspects as ways to enact 'connection and care' in a retelling of the Anthropocene (Buck 2015), but rather as possible ways to help transcend it. Working with the 'intuition that something fundamental has shifted' (Stengers 2015a: 134), I argue that the task of responding to this fundamental shift cannot be left to modern techno-sciences alone. Their constraints of separation of nature from culture, smoothening of ontological differences and preference for linear cause-to-effect relationships, may actually be detrimental for this task of responding.

To transcend the Anthropocene, following Stengers (2015a), the fundamental shift may be approached through the figure of Gaia. Quite unlike the Anthropocene, Gaia is not a modern technoscientific creation. It is instead 'a bastard child of climate sciences and ancient paganism', which exists 'in its own terms, not in the terms crafted to reliably characterise it' (Stengers 2015a: 134, 137). Embracing Gaia thus opens the door for halting modernist techno-science's onslaught against diverse practices classified as indigenous, traditional, vernacular, religious or spiritual. Unfortunately this onslaught is not just historical. It continues, for example, in the form of ethnocide perpetrated by large dams such as the Belo Monte in Brazil (Hanna *et al.* 2016), and in the form of destruction of marine environments by plastic debris (Derraik 2002; Iñiguez *et al.* 2016).

Finally, the four aspects of caring engagement outlined in this paper should not be treated as *a priori* principles to guide engagement between transforming practices. Instead I hope that they are put to work as questions addressed to specific encounters between divergent practices, gaining relevance in the practices' transformation to become minoritarian through caring engagement with others. This relational transformation of practices may be crucial for developing collective responses to the myriad political-ecological challenges facing Gaia today.

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