

The Question Concerning Geo-Engineering

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Abstract: The Anthropocene, as we encounter it now, is the age in which we can no longer avoid postnaturalism, that is, a view of the ‘environment’ as largely ‘built.’ This means that we exist in a highly technologically mediated relationship to the rest of the earth system. But because the Anthropocene has barely emerged this time is best thought of as a transition phase between two epochs, i.e., it is ‘the end-Holocene.’ The end-Holocene is essentially a period of ecological crisis, the most salient manifestation of which is anthropogenic climate change. Given our political inertia, some have suggested that we should we respond to the climate crisis through technological manipulation of the global climate: geoengineering. The proposal raises many questions. The one I am interested in here is whether or not geoengineering represents an objectionable species-level narcissism. Will deployment of these technologies effectively cut us off from contact with anything non-human? This is what I’m calling ‘the question concerning geoengineering.’ I show how Heidegger’s philosophy of technology, especially his concept of ‘enframing,’ can help us think about the issue with the seriousness it demands.

Key words: geoengineering, end-Holocene, Anthropocene, Heidegger, postnatural, enframing

1. Introduction

Almost all the attention paid by philosophers to geoengineering has concerned its ethical status: is it morally permissible or not to deploy these technologies? This—the problem of justice—is crucial but in this paper I will examine a different, though no less important, question. The very idea of geoengineering—intentional technological manipulation of the global climate—frightens many people because it is plausible to view these schemes as the quintessential expression of

our domineering attitude towards nature. Is it really wise to seek control over the entire earth system in this fashion? Will anything non-human be left for us to encounter and wonder at after imposing ourselves on the planet in so imperious a fashion? This is what I'm calling 'the question concerning geoengineering.' As the title indicates, I will address it through the lens of Heidegger's analysis of modern technology. Although it might appear as though Heidegger provides comfort to opponents of geoengineering, I show that there is a more subtle way of interpreting him, a way that might allow for a geoengineering that does not enclose us in a world entirely of our making.

First, however, we need to situate the discussion in the context of debates about the Anthropocene. I do this by analyzing various 'narratives of the Anthropocene' proffered (mainly) by social scientists (section 2). Next, I examine the nature of geoengineering, why some have thought recourse to these technologies will be required in the years to come, and why the debate between boosters and detractors is superficial (section 3). This brings us to Heidegger. Here, I show that in his philosophy of technology, Heidegger anticipates the worries many are now expressing about the Anthropocene. Specifically, he highlights the process by which we are enclosing ourselves in a made world and thus shutting ourselves off to genuine alterity. Heidegger, I claim, both explains what there is to worry about here—namely, that we are reducing how Being is revealed to what can serve our narrowly defined interests, which is one way of forgetting the ontological difference between Being and beings—and provides grounds for hope that geoengineering technologies might avoid this outcome (section 4). I close by addressing a potential objection to my account (section 5).

2. Narratives of the Anthropocene

Even though there are virtually no book length treatments of the Anthropocene by philosophers,¹ there is a distinctly philosophical issue in the burgeoning social scientific literature about it. The issue has to do with competing visions of what the Anthropocene *is*, many of which take the form of 'narratives' of the new epoch. Christophe Bonneuil for example argues that there are at least four dominant narratives of the Anthropocene. The first is the Naturalist, which focuses on the specific groupings of humans over the ages, from hunter-gatherer to "global geological force" (Bonneuil 2015, 19).² The key here is that the species is viewed homogeneously, a point picked up by critics who insist that this type of species-level thinking is "conducive to mystification and political paralysis" (Bonneuil 2015, 21).

The second narrative involves the claim that we have come to the end of nature, a way of thinking which allegedly “shares the Promethean tropes” of the first narrative (Bonneuil 2015, 24). This has sometimes been characterized as ‘The Good Anthropocene’ because its proponents tend to be quite optimistic about technology’s promise to get us through the various storms we are likely to face in the near future.³ This is thus a view that is held to both deny “alterity” in nature and “intensif[y] and accelerates modernity” (Bonneuil 2015, 26). Third, there is the narrative of eco-catastrophe, according to which we are moving towards “tipping points, collapse, violence, and wars” (Bonneuil 2015, 27). Although he is difficult to pin down, at times Timothy Morton seems to fit this description (see, for example, Morton 2013). The fourth narrative is the eco-Marxist. Here, capitalism is exposed as waging a kind of ‘war’ on nature (Foster, York, and Clark 2011). The eco-Marxist narrative is often set in direct opposition to the homogenizing tendencies of the Naturalist. The Anthropocene is thus a misnomer: the new epoch should be called the Capitalocene or the Technocene because, as Alf Hornborg puts the point, “the uneven distribution of modern, fossil fuel technology is in fact a condition for its very existence” (Hornborg 2015, 60; see also Foster, York, and Clark 2011; Moore 2015.).

Bonneuil’s explicit point in putting together this catalogue of narratives, which is not meant to be exhaustive,⁴ has been to remind us of the “black boxes of the Anthropocene discourse,” an intervention that he hopes will ultimately “re-politicise” our discussions of this issue (Bonneuil 2015, 29). He leaves it to others to choose among the options.⁵ In my view, it is crucial at this stage precisely to resist this temptation, at least with respect to the proffered alternatives. The narrative approach to the Anthropocene is itself probably unavoidable.⁶ This is because we are now being asked to think in deep time, to somehow place our present selves in an immensely expansive chronological order. For instance, we can now say that looking in one temporal direction the climate we are in the process of creating has not been seen on earth for tens of millions of years, while looking in the other temporal direction this very fact will alter the earthsystem for at least the next 100,000 years (Stager 2011).

What could it even mean to choose *an* appropriate narrative here? Because it is a way of structuring a whole—an individual life, a family’s or nation’s history, etc.—constructing a narrative demands that we possess a relatively well-circumscribed understanding both of the temporal boundaries in which we are interested and the salient facts or data points within those boundaries. This means that prior to the formal construction of the narrative, we have reasonably reliable epistemic

access to a coherent picture of the relevant temporal whole even if the construction of the narrative itself is required to bring the detail perspicuously to the light.

Given the various forms they can take, we can be ecumenical here about what counts as a narrative. To take a few examples, a thorough historical narrative of a past economic recession will need access to records of specific policy decisions, economic analyses and testimonials; a convincing fictional narrative may need to draw on plausible psycho-causal claims about how certain events in early childhood played a decisive role in, say, the formation of a character's adult neuroses; a genuinely inspiring political manifesto must make connections between the way the world is now and the way it both should be and will be given the right sort of social push. And so on.

I don't think we have anything analogous to these kinds of structures in the case at hand, *the* narrative of the Anthropocene. Bonneuil's options are all, in their ways, surely correct. It is true to say that the Anthropocene forces species-level thinking on us, that our way through the crises we face will involve a more determined engagement with technology, that if we persist in our political inertia we will invite catastrophe, and that the whole thing would not have taken the form it has without the mediation of neoliberal capitalism in the age of fossil fuels.

The Anthropocene is, so far, too amorphous a phenomenon to answer to any one of these descriptions. We need all of them and more besides and, again, this is chiefly because we have no satisfyingly bounded concept with which to work here. To clarify, the claim is *not* that we should be skeptical about the discoveries that much of the stock of greenhouse gases we are placing in the atmosphere will still be wreaking havoc on the climate in 100,000 years, or that the average temperature increases with which we are flirting will take the planet back to the Eocene. Rather, what I am claiming is that we currently have no idea how *we* fit into this newly proposed chronological order. That's the main point of contrast between the three examples of narrative just sketched on the one hand and the fully-fledged phenomenon of the Anthropocene on the other.⁷

Insofar as it emphasizes the need to simply live patiently with a diversity of competing interpretations, the suggestion just offered can inspire philosophical frustration. But there's a way out of this impasse. In his recent history of the Anthropocene, Jeremy Davies has argued that it is best to think of the new epoch, as we encounter it now, not as something fully formed but rather as a transitional phase (Davies 2016). This is why his book is called *The Birth of the Anthropocene*. He is telling the history of the very beginning of this phenomenon. But of course any such history is bound to involve substantive reflection on that from which the

new is emerging, the thing that is in its death throes as it were. With respect to *that* thing—the expiring thing, in this case the climatically stable Holocene—it is surely appropriate to invite the Owl of Minerva’s flight.

In my view it makes little sense at this point to attempt to pick out the essential properties of the Anthropocene, and if a large part of philosophy’s task just is the attempt to pick out essential properties of entities then we must conclude that it is too early to philosophize about the Anthropocene. But it is entirely appropriate to philosophize about what Davies calls the ‘end-Holocene’ because we know quite a bit about the Holocene itself.⁸ After all, we have been thinking about the nature of Agricultural/Industrial civilization for some time. And so we can now see some of the problems we face precisely as intensifications or culminations of forces that have been operating for centuries or even millennia. The end Holocene has at least three features that advocates of the various narratives just canvassed should all really agree on. Indeed, I would suggest that consent to these three features is something of a litmus test for reasonable views about the Anthropocene *qua* end-Holocene.

First, the end-Holocene is an age of crisis, at least in its present manifestation or stage. Announcing that we are in the Anthropocene amounts to noticing that the earth system has been destabilized anthropogenically, in a way or to a degree that will pose profound challenges for humanity as well as many non-human species. Second, the signal epistemic mark of the times is uncertainty about how the future will go. Two features of this uncertainty stand out: it is deep and risky, to the point—often—that the key decisions we and, especially, our successors must make will be best characterized as tragic or even absurd choices; and it is theoretically pervasive, affecting science and economics no less than philosophy.⁹ Third, we humans are, I will urge, essentially technological entities whose environment is already largely built. In other words, my understanding of the end-Holocene is meant to align with the recent ‘postnatural’ environmental philosophies—which together encompass ontology, ethics and politics—of thinkers like Bruno Latour (1993), Braden Allenby and Daniel Sarewitz (2011), Andrew Biro (2005), Steven Vogel (2015), Simon Hailwood (2015), and Jedediah Purdy (2015).

This third claim requires more analysis. It has been said that crisis phenomena like climate change and the sixth mass extinction have effectively killed ‘nature.’ The ‘death of nature’ thesis was first put forward by Bill McKibben (1989) and has been philosophically elaborated and defended most recently by Vogel (2015). A prominent way of conceiving of ‘nature’ in contemporary philosophy and culture is that it is something ‘external’ to humans, that it functions ‘independently’

of our aims and interests, that it is ‘untouched’ by humans, that it is ‘separate’ from human society, and so on (Katz 1997). McKibben for example says that we have come, rightly, to *define* nature as that which is independent of us (quoted in Vogel 2015, 9). Of course, these are also, and perhaps more frequently, the ways in which we refer to ‘wilderness,’ which is often simply equated with ‘nature’ (or we get the pleonasm, ‘wild nature’). And the invocation usually comes positively charged: nature or the wild is seen as that which is unspoiled and which is, as such, supposed to provide some sort of normative standard for us.¹⁰

Let’s note three points about this conception. First, the crisis phenomena make it difficult to see how there could any longer *be* something independent of the human. For instance, because anthropogenic climate change has already raised average global temperatures by about 1° C relative to the pre-industrial baseline, there is now not a single square centimeter of the planet that has not been affected by the changes this has wrought, however subtle such changes may be in many cases. So a *comprehensive* explanation of why anything in the biosphere behaves the way it does—minute adjustments in the migratory paths of Arctic warblers, small increases in the beetle populations of temperate conifer forests, the barely perceptible thinning of the calcified exoskeleton of coccolithophores in the Indian Ocean, and so on—must make reference to anthropogenic causes.

Second, Vogel argues that the concept of nature is ambiguous in writers like McKibben. The concept has two possible meanings, which Vogel labels ‘Nature’ and ‘nature.’ Nature (upper case) refers to everything that is, while nature (lower case) refers to that which is independent of the human. The opposite of ‘Natural’ is ‘supernatural’ and the opposite of ‘natural’ is ‘artificial.’ Think of this in terms of the positive charge I was just talking about. Sometimes it is said that the problem with contemporary humanity is that we are ‘estranged’ from nature or the wild and this estrangement is what has allowed for such widespread environmental devastation (note the phenomenon of ‘nature deficit disorder,’ for instance).

But what could this mean? We cannot be estranged from Nature because what we do, even the environmentally destructive stuff, is part of everything that is (Vogel 2015, 12). Nor, however, does it make much sense to *complain* about our estrangement from nature if the latter is defined as the nonhuman. For Vogel it follows that when we do environmental politics, we need to clarify our relationship to our environment with a single category of being: *the built environment*. This is an ontologically undifferentiated field encompassing the insides of our bodies, our urban architectural forms, the Eastern Siberian taiga, the stratosphere, and all

points in between. In the end-Holocene humanity is effectively everywhere and this means that our technology is effectively everywhere.

This brings me to the third point, best taken as a caveat to what has just been argued. I have been saying that according to the postnaturalist the environment is ‘largely’ built, not ‘entirely’ built. From the fact that a *comprehensive explanation* of natural phenomena must make some reference to anthropogenic forces it does not follow that only such forces are explanatorily important, or even that they are always going to be relevant to our understanding of some natural phenomenon. The fact that the migratory patterns of the Arctic warbler have been perturbed by global warming is irrelevant to a whole array of interesting micro-questions about the way this species goes about its business: how it metabolizes food, keeps itself warm, protects its young, and so on. A plausible post-naturalism will deny none of this. It will be crucial to bear this point in mind in the context of our discussion of auto-poeisis, in section 4.

We need to ask some very basic questions about what it means to be human in such a postnatural landscape. This task sounds daunting but perhaps we can approach it more confidently by narrowing our critical gaze. If the signature crisis event of the end-Holocene is climate change—and together with the sixth mass extinction (which is itself in large part an effect of climate change) it surely *is*—then its signature ‘ameliorative’ technology is geoengineering. So far, this is a claim only about how this technology is understood among a broad swath of engineers and policy makers. Before endorsing it we must examine it more critically.

3. Geoengineering in the end-Holocene

According to the influential Royal Society Report on the topic, geoengineering can be defined as “the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change” (Shepard et al. 2009, 1). The idea has gained considerable traction in policy circles recently. Indeed, in its most recent (2014) report the Intergovernmental Panel on Climate Change (IPCC) has, for the first time, provided a synthesis and assessment of the current literature on this topic.

Geoengineering comes in two broad forms. The first aims to remove carbon from the atmosphere. This includes enhanced biochar production, reforestation, iron filings in the oceans, direct removal of carbon from the atmosphere, and so on. The second is solar radiation management, or albedo modification, the attempt to increase the planet’s capacity to reflect sunlight. This category includes mirrors in space, injection of sulfate particles in the stratosphere and cloud seeding. How

we assess geoengineering as a practice will depend on which of these technologies we are talking about. As the U.S. Academy of Sciences points out, in general carbon removal techniques are less risky than albedo modification techniques (see Romm 2016, 165). However, they are problematic for other reasons. For example, to reforest the planet on the scale required would put acute pressure on agricultural land use. Meanwhile, the idea of sucking carbon out of the air is pure fantasy at this stage and it is hard to see how the biochar option—itsself quite benign—can be scaled-up adequately.

By contrast, albedo modification appears to be a relatively cheap and technically feasible set of options, so in this paper I will assume that this is the sort of intervention—especially stratospheric sulfate injection—that is most likely to be adopted if any is. But surely there are alternatives to this sort of large-scale manipulation of planetary systems.¹¹ Biomimicry, for example, seeks to learn lessons from nature at the micro-scale and apply them to our own problems.¹² For example, we might better learn how to keep our buildings cool by studying the way termite colonies keep internal temperatures relatively low for the structure's inhabitants. This way of seeing things might encourage us to seek out lots of small solutions to our problems rather than just a few big ones. It might, for instance, encourage us to develop distributed energy systems based on renewables.

There are two issues here. First, it is important to note that some geoengineering techniques are themselves examples of biomimicry. The idea of loading the stratosphere with sulphates, for example, was inspired to some degree by noticing that average global temperatures dropped after the eruption of Mount Pinatubo in 1991, so that it is now common to think of this technique as creating 'artificial volcanoes.' The same is true of artificially enhancing biochar production or marine photosynthesis, both of which are aimed at mimicking processes we have noticed going on all by themselves in nature. If some geoengineering schemes are forms of biomimicry, then the latter is not an *alternative* to the former.

The second and more pivotal issue concerns scale. Can small-scale technologies help us avoid climate catastrophe? In my view, although we should be devoting far more of our resources into developing them, renewable energy sources are unlikely to be scaled up in time to avert disaster. At the scale required to meet the world's energy demands these are technologies for the middle and farther futures. We should begin switching aggressively to them now (on the model of Germany), but also recognize that the relevant data here are daunting. Almost all of our energy—about 87 percent—still comes from fossil fuels, the remaining 13 percent split among nuclear, hydroelectric, solar and wind (Gardiner and Weis-

bach 2016, 182). This means that we are in the very early stages of the required energy transition.

The best way to estimate how long it will take to complete it is to compare it to previous transitions from one dominant energy source to another. According to David Weisbach, the transition from biomass to coal took approximately 130 years while the transition from coal to oil and gas took about eighty years. (Gardiner and Weisbach 2016, 183). The reason we should not be naïve about improving on these timeframes is that we continue to build fossil fuel infrastructure, effectively locking in the present regime for generations.¹³ But a recent study shows that if we are to remain below 2° C, 80 percent of the world's coal, 35 percent of its oil, and 50 percent of its gas need to remain in the ground (McGlade and Ekins 2015).¹⁴

There is therefore nothing at all hyperbolic in saying that we are currently sleepwalking into a situation of civilization-threatening social and political chaos and that we need to think hard about how to ameliorate the worst impacts of climate change. This stark set of facts is what has prompted many people to consider the possibility of geoengineering.¹⁵ The way Oliver Morton puts the point is typical of the bluntness one finds in these discussions. Morton argues that there are just two questions to be asked about our current situation. First, “do the risks of climate change merit serious action aimed at lessening them?” Second, is reducing the global economy's reliance on fossil fuels to near zero, as is required to avoid climate catastrophe, going to be “very hard?” (Morton 2015, 1). We are assured that the only rational response to both questions is ‘yes.’ If we want to avoid climate change-induced disaster, and given our inertia on mitigation, geoengineering is then presented as the only “serious action” remaining to us.

Gardiner has labeled this the “lesser evil” approach to geoengineering (Gardiner 2010; 2011, chap. 10). Obviously geoengineering is risky, but not as risky as the only other alternative—climate disaster brought on by our lingering political inertia—so it is rational to develop and deploy it as required. The policy-driven consequentialist approach to geoengineering rests, however implicitly, on our ability to calculate the likely effects of competing possible outcomes with some confidence.¹⁶ But what is the basis of this confidence? Morton does not neglect to discuss the many dangers of geoengineering: the moral hazard problem, the potential for weaponization, the problem of creeping ocean acidification (if we create a stratospheric veil of sulphates we can continue to burn fossil fuels, which means that the amount of carbon dioxide going into the oceans is increasing), and profound governance issues.

And yet, he appears positively dewy-eyed about the capacity this technology affords us to extend our control of the earth. Indeed, he thinks that it will provide an opportunity “for justice and sympathy to spread out through the human world and into the earthsystem beyond” (Morton 2015, 31). This is surely Prometheanism run amok. Indeed, on this understanding of the issue it is difficult to see why we would refrain from geoengineering the planet even if there were *no* climate crisis. After all, as Morton tells it, “there is a particular appreciation of wonder of the earthsystem that can be gained only by imagining how it could be changed” (Morton 2015, 31). Why wait for a catastrophe if the intellectual gains to be had from this sort of manipulation don’t require it?

But if geoengineering were in truth *the* rational response to the climate crisis its defenders make it out to be, then the ‘sums’—the tally of harms avoided through the implementation of this or that geoengineering scheme—should show this clearly to be the case. But boosters like Morton never give us the sums. The reason for this omission is simple: although both climate catastrophe and large-scale geoengineering are likely to result in widespread human suffering and damage to the biosphere, we have no precise idea which option will be worse and no idea therefore which of the two is the ‘lesser’ evil.

But those who are categorically opposed to geoengineering have a similar argumentative burden, which is rarely discharged. Thus Bonneuil and Fressoz, citing the “hundreds of thousands of premature deaths” likely to result from the creation of a cooling veil (while ignoring all the death that climate change will cause), argue that geoengineering is to be rejected as a form of “geopower” that “reifies” the earth as “an object of experimentation and control” (Bonneuil and Fressoz 2015, 91). Similarly, Clive Hamilton (2013) argues that geoengineering is hubristic and dangerous and ought to be abandoned on those grounds. Again, these descriptions of geoengineering are not necessarily false, but they do not present *arguments* for rejecting geoengineering out of hand. Perhaps it is, for instance, just a regrettable fact of the human condition in the end-Holocene that some ‘reification’ of the earth system is unavoidable and that this will manifest as a possibly dangerous flirtation with ‘geopower.’ The revulsion or horror this causes in us must be faced squarely, in my view.

We are tending to a dying patient—the Holocene—and are forced to consider whatever measures will keep it alive the longest so that we have time to reorganize our societies in accordance with what awaits us on the other side, the Anthropocene proper. The first way to put the question concerning geoengineering, therefore, is whether or not it might provide the *bridge* we need from the end-Holocene

to the Anthropocene (I will refine this question in the next section). If not, then detractors need to tell us what other bridge is available to us in the short time we have to figure out a way forward; if so, we need to think hard about how to deploy these technologies in a way that also allows us to constrain them in specific ways.

We might say that while the problem with geoengineering's boosters is that they focus on our superhuman possibilities, the problem with its detractors is that they fix on our inhuman possibilities. Geoengineering will either help us fulfill the Enlightenment dream of establishing control over the earth system or it will be used as a weapon against whole continents. These are oversimplifications of the challenges we face. Because we live in a postnatural age, in the qualified sense argued for in this section, what we require is a philosophical conception of geoengineering technology that is neither moralistically or nostalgically dismissive of it, nor blindly submissive towards it. Since I think Heidegger's views on technology stake out this middle ground with unmatched philosophical depth and richness, it is time to turn to a consideration of his views.

4. Enframing and Autopoietic Alterity

My goal in this section is by no means to provide an exhaustive account of Heidegger's understanding of modern technology, but only to show how the notion of enframing (*Gestell*) and its cousin concepts can help illuminate the human condition in the end-Holocene and more particularly the philosophical meaning of geoengineering. Enframing, for Heidegger, is a historically specific mode of technological development, one that "challenges" nature to reveal itself as "standing-reserve" (*Bestand*).

Enframing the real makes it available through the process of ordering it in a specific manner: by "[u]nlocking, transforming, storing, distributing, and switching about." Most importantly, enframing the standing-reserve is a way of "regulating and securing" its forces (Heidegger 1977, 16–17) for human purposes. There is nothing narrowly artificial about this process. For Heidegger, it is a mode of revealing or unconcealment. A fruitful way to put this is in terms of Heidegger's concept of the metaphysics of 'presence' (*Anwesenheit*), the manner in which beings become manifest within a world. As John Richardson interprets the concept, it has principally to do with "proximity" to a viewpoint, securing entities in a durable manner. And this notion pivots on the idea of *controlling* entities (Richardson 2012, 218–19).

The tendency to bring beings into presence so that they may be more durably controlled—theoretically and/or practically—has been a persistent feature

of Western metaphysics ever since Plato, but the key point here is that it intensifies historically (this, for example, is why Heidegger can speak of Nietzsche as ‘consummating’ the tradition). As Richardson puts it, “the tendency towards a maximal control culminates in our own current opening to being, technology” (Richardson 2012, 233). Enframing “drives out every other possibility of revealing,” and in particular it “blocks *poiesis*” (Heidegger 1977, 30). This is a key point for my purposes. How does enframing, expressed most perspicuously in modern technology, effect this blocking? Heidegger says that “what presences by means of *physis* has the irruption belonging to bringing-forth” (Heidegger 1977, 31). This is usefully parsed by Henry Dicks as referring to “the causally circular, self-referential bringing-forth characteristic of living beings [which] is essentially the same as what Maturana and Varela call autopoiesis” (Dicks 2011, 49).

Enframing has a tendency to block *physis* considered as *autopoiesis*. By way of elucidation of this concept, think of Heidegger’s analysis of the poetic fragment of Angelus Silesius, “the rose is without a why: it blooms because it blooms.” For Heidegger, “the blooming is grounded in itself, it has its ground with and in itself” (quoted in Dicks 2011, 49).

Physis . . . the arising of something from out of itself, is a bringing-forth, *poiesis*. *Physis* is indeed *poiesis* in the highest sense. For what presences by means of *physis* has the bursting open belonging to bringing-forth, e.g., the bursting of a blossom into bloom, in itself. (Heidegger 1977, 10)

The way we are enjoined to think about the rose here is in defiance of the metaphysics of presence which, as we have seen, secures entities in place by relating them to an external viewpoint: a causal network, theoretical framework, practical scheme, etc. Of course, we can generalize beyond the rose: to encounter nature autopoietically is to experience it as self-emerging, where the ground of its being is not related to that which is other than it. This is in its essence an encounter with natural alterity. It is a special sort of way to dwell among other beings. Insofar as we seek out experiences of the ‘wild,’ experience biophilia in nature, philosophize about the ‘intrinsic value’ of the living, and so on, this is, I suggest, what we are trying to capture. In any case, it is the sort of possible encounter with which I am principally interested in this section.

But for Heidegger this experience with beings cannot happen until we are capable of noticing something more primordial: presencing itself. We cannot escape presencing altogether for it is simply the way revealing occurs in any historical epoch. The key issue is whether we can resist the *metaphysics* of presencing that

is peculiar to our age. According to Heidegger, we have forgotten *that* Being presences and so have closed ourselves off to other ways in which it might do so, in the process confusing beings with Being. Are we any longer capable, as the pre-Socratics allegedly were, of experiencing “what is present *as* what is present.”¹⁷ According to Richardson, genuine thinking “needs not only to notice presence but to see it *as* an interpretation of Being” (Richardson 2012, 252).

In other words, coming to grips with the nature of presencing is equivalent to thinking the difference between Being and beings. Full discussion of the ‘ontological difference’ is beyond the scope of this analysis but we cannot ignore the fact that our oblivion to this difference is, for Heidegger, what has allowed for the dominion of enframing in our times.¹⁸ Thinking the ontological difference can facilitate encountering nature with wonder and reverence rather than a desire to control and order.¹⁹ Here, wonder and reverence are products of noticing the radical alterity of that which is, its self-emerging ownness. It is to be content to watch and marvel at auto-poietic presencing. But the more fundamental thinking of Being—grasping presencing *as* presencing—must precede this encounter with beings. This is the only way to loosen the grip of enframing. Enframing, recall, is a ‘culmination’ of metaphysics because it is the most thorough expression of the urge to capture reality in a totalizing picture.

So another way to frame my concern in this paper is to ask whether the attitudes of reverence and wonder are still possible vis-à-vis the natural world in the crisis-ridden end-Holocene, precisely to the extent that we are evidently seeking large-scale technological ways of dealing with these crises. Heidegger thinks that the culminating phase of enframing involves the way we capture energy: “[t]he revealing that rules in modern technology is a challenging, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such” (Heidegger 1977, 14). Clive Spash has claimed recently that responding intelligently to climate change should be seen as a way of “managing the carbon cycle” (quoted in Jamieson 2014, 136). Spash is talking about the carbon cycle as a regulator of the planet’s store of thermal energy.

If we control *this*, we have apparently reduced an entire planetary system to our demands. I take Heidegger’s talk of ‘challenging’ in this context to indicate a reduction of precisely this sort, so Spash’s ambition reveals the prescience of Heidegger’s way of understanding modern technology. If we understand geoengineering as part of this project of planetary control, we can see it as a key manifestation of the problematic ‘challenging’ Heidegger is talking about. My suggestion has been that enframing can close us off to the sort of mystery that is involved in our

encounters with genuine otherness or alterity. And when the earth has become an object of manipulation on the scale required to geoengineer it, it *seems* as though nature loses its alterity altogether. In this case, we are presented with a world in which it appears as though “man everywhere and always encounters only himself” (Heidegger 1977, 27).²⁰

This is surely something to eschew if we can and yet the question always resurfaces: what about climate change? Let’s remember how fondly Heidegger thought of his Black Forest idyll, a place in whose natural beauty he reveled. According to the latest IPCC report this region of Europe, tucked away in Germany’s southwest corner, will experience profound effects from climate change in the coming decades. Of particular concern, the forest fire risk for the region containing the Black Forest moves from “low” in the baseline climate (1961–1990) to “high” in the climate scenario analyzed (a non-extreme scenario, it should be emphasized) (IPCC 2014 23.4.4, 1287). Further, the projected increase in forest fires will increase GHG emissions from this area because of the burning biomass it will create, a positive feedback that may increase the likelihood of more forest fires. An *additional* 8 percent to 19 percent of German forests will be lost due to increased storm activity caused by a reduction in the time the soil is frozen, an effect that will be most pronounced in mountainous regions such as the Black Forest (ibid., 1288).

Knowing the profound value he placed on this piece of Holocene landscape, we might therefore wonder what Heidegger himself would have made of the threat it faces. More particularly, we might wonder whether or not he would have welcomed a technological intervention into the earth system whose goal was to preserve places like this in much the same state as he encountered them. This is not to romanticize Heidegger. In my view it is a mistake to think of him as seeking contact with a natural world that is fully unmediated by technology. Indeed, that is the point of suggesting that he himself might accept a technological intervention on the scale of geoengineering, if the only alternative was the destruction of a part of the natural world he clearly valued.²¹ These are purely speculative questions, of course, but the point is to see if there is purchase for these kinds of ideas in Heidegger’s philosophy of technology. I think there is.

Geoengineering is a form of enframing technology. After all it does—especially when it takes the form of albedo modification—seek to *order* the planet’s supply of solar energy. But it does not follow that even as bold an enframing project as this converts everything it touches into a fully *controlled* bit of standing reserve, and this is the essential point. It is crucial to separate these two processes: bringing order and controlling. If it works, geoengineering can bring some order

to the climate in the simple sense that it will keep average temperatures relatively stable. Here, ‘order’ just means rough alignment with established purposes, for example those expressed in the way our agricultural system is set up. Control of nature, by contrast, implies full reduction of natural processes to our purposes. To relinquish the dream of control over nature—even as we order it in fairly ambitious ways—is to allow space for the emergence of alterity. Thus geoengineering need not *determine* the permanent presencing of being.²²

Here’s another way to put these points. Speaking of what needs to be done to reform the “device paradigm” of technology, Albert Borgmann says that the latter must be restricted to its “proper sphere,” namely the “background of focal things and practices” (Borgmann 2014, 343). Borgmann himself is not very precise about what background technologies are. He seems to think that so long as an array of traditional practices are allowed to flourish—things like running, fly fishing, the family meal, etc.—then we can allow the rest of our lives to be made easier and more efficient with modern technologies (transportation technologies, for example).

The purpose of geoengineering technologies is *preservationist*. That is, they would be deployed only in order to keep our planet in something like its Holocene state for as long as it takes to transition to a safer planet powered by renewables. This would, ideally, allow time for the collection of our foreground practices—think again of the global agricultural system—to adapt to the new reality. Moreover, from the standpoint of this paper’s focus on accessing the natural world, it is telling that Borgmann identifies “the wilderness” as a focal thing (Borgmann 2014, 343), one that presumably could be experienced with satisfaction against a technologized background. Borgmann does not tell us what he means here, so let’s extrapolate.

Imagine a hypothetical future in which you, an avid hiker, are vacationing in the Rocky Mountains, a region whose climate has been manipulated by some form of geoengineering. Suppose, in addition, that the place has been rewilded so that it contains most of the flora and fauna it had before climate change reduced its biodiversity dramatically. In other words, the area has been extensively *designed* to make the experience of ‘wilderness’ indistinguishable from one unmediated by humans, partly in order to cater to nature enthusiasts like you. What exactly is objectionable about this? It is difficult to say so long as the foreground experiences of the ‘wild’—from the lush trees of the Boreal Forest to the trout in the rivers—is more or less what it was at some past Holocene baseline. These thoughts finally allow us to crystallize the question concerning geoengineering: can this technol-

ogy be confined to the background of our focal concerns in this manner? Surely the answer is yes. Properly construed, geoengineering seeks only to preserve the world in much the same condition as we already experience it. Qua background technology it does not give us full control over postnature. This means that even in deploying it we might effectively resist enframing's totalizing tendency.

The view I'm advocating here implies a kind of humility about the technological enterprise that is missing in some of geoengineering's more ardent boosters. Morton, as we have seen, seems to think that geoengineering ought to be pursued as an end in itself because it expresses the sort of control over the earth system to which we have always (putatively) aspired. Borgmann is at pains to emphasize that background technologies must always be "recognized" as means and never be mistaken for ends (Borgmann 2014, 343–44). This could be one way of keeping in view presencing *as* presencing in the age of enframing. As such, it could make it easier to abandon this technology when it is no longer required for the ends to which it had originally been fitted. This is crucial if we are to treat this technology as a mere bridge between the end-Holocene and the Anthropocene rather than a self-justifying extension of our control over the earth system.

If a stratospheric veil were imposed successfully the Black Forest would at least stand a chance of avoiding the scorched and battered fate that otherwise awaits it. And all the auto-poietic processes that unfold in that landscape—and many others, like my re-imagined Rocky Mountain biome—could still be encountered with due reverence and wonder. Here we would not be self-deceptively experiencing human-made things as though they were something else. We would, on the contrary, be experiencing nature-as-*physis* even as its emergence in this or that form was made possible, in part, by an engineered climate. This is one expression of the paradoxical task of remaining open to alterity in the age of the postnatural.

5. Conclusion

My purpose in this paper has been to blunt a particular challenge to geoengineering: the one emanating from concerns about making nature over entirely in our (technologized) image, such that we render ourselves permanently closed off to Being's possibilities. For Heidegger this danger is inherent in the consummation of Western metaphysics achieved in the modern era. But I have also argued that Heidegger's philosophy of technology does not necessarily provide warrant for a wholesale condemnation of geoengineering.²³ Insofar as large-scale technological interventions into nature are unavoidable in the Anthropocene, so is the danger they bring. Because he understands this basic reality better than any other thinker

Heidegger is, we might say, the first great philosopher of the new epoch (albeit *avant la lettre*).

Now, it might be suggested that even if certain autopoietic processes could flourish in the geoengineered world I have imagined—the micro-behaviours of the Arctic warbler, and so on—surely the system *itself* is no longer capable of doing so. In other words, does ‘successful’ geoengineering not put an end to what Dicks calls “Gaian autopoiesis”?²⁴ In response, consider again the distinction between ordering and controlling. Although geoengineering is sometimes characterized as affecting *the* earth system—a convention I have been following in this paper—in truth it aims at *ordering* it, by regulating one of its sub-systems. Managing the atmosphere in this sense does not give us full *control* over the earth system. This could happen only if we were also intentionally manipulating the geosphere, the biosphere and the hydrosphere.

These systems are not hermetically sealed, of course, and so manipulation of the atmosphere will have knock-on effects in the other sub-systems. So we will sometimes need to find ways of ordering those systems too. This is just another way of talking about the multi-faceted challenges of adapting to climate change. But with respect to all these subsystems we can stop short of full control, and this matters immensely. Thus if Gaia is the totality of these systems, then much of its processes can persist relatively undisturbed throughout a regime of geoengineering. Indeed, one of the reasons it makes sense to say that micro autopoietic processes can continue in this context is precisely because the climate system is *not* the whole earth system.

We can see why the temptation of geoengineering goes to the heart of what we understand as the human condition in the new epoch. For it forces us to confront a question that has been lurking in our culture since the advent of technoscience. Are we the lords and masters of the planet, finally presented with the technological means of realizing our ambitions? Or are we willing instead to live with and even cultivate our access to alterity, seeing ourselves as what Aldo Leopold called “plain members and citizens” of the biosphere (Leopold 1989, 238)? I hope we adopt the latter self-understanding because it expresses a commitment to live gracefully in this mostly non-human place, even as we render it more dangerous—and not just for our species—by geoengineering it. If what I have argued here is sound there is a way of keeping this technology from becoming a full interruption of “the higher-order autopoiesis of Gaia” (Dicks 2011, 55), and this might be the best we can do for now.

If we conceive of geoengineering as a mere bridge, the partially engineered background that still enables encounters with autopoietic unfolding, if we refuse to lose sight of the fact that it is only a means to a better future, if we refuse to allow technicians to set our ends for us, and if we can think enframing's presencing *as* presencing in the Anthropocene, then we might learn to dwell more responsibly on this planet in these parlous times.

Notes

1. The exception is Williston 2015.
2. The key figure here is Dipesh Chakrabarty. See especially Chakrabarty 2009; 2015.
3. This is a large group, comprising figures like Stewart Brand, Ted Nordhaus, James Lovelock, Earl Ellis, and others. A full statement of the position can be found in Asafu-Adjaye et al. 2015.
4. The four narratives just sketched are meant as a survey of the relevant literature. Bonneuil and Jean-Baptiste Fressoz, both historians, in fact provide us with more such narratives: the Thermocene, the Thanatocene, the Phagocene, the Phronocene, the Agnotocene and the Polemocene. I think this is exactly the sort of thing we need from social scientists. See Bonneuil and Fressoz 2015.
5. For an altogether different way of drawing the boundaries among these narratives, see Dalby 2016.
6. I have contributed to it myself. See Williston 2015.
7. It might be objected that we do have a clear idea of at least the beginning of the Anthropocene even if we cannot foresee what shape it will take in the future or how long it will last. But, first, there is still plenty of dispute about when to date this beginning. Candidates include: the Agricultural Revolution (Ruddiman 2013); the Industrial Revolution (Crutzen and Stoermer 2000); and the Great Acceleration (post-1945) (Steffen et al. 2015; Williston 2016). Secondly, even if there were consensus on the starting date, the point I am making here is that such a dating does not fully circumscribe the new epoch theoretically. The fact that we have resorted to deep-time comparative paleoclimatology in order to *understand* what we are doing to the earth system is evidence of this.
8. Since I'm going to be talking about Heidegger at length below, it is tempting to relate this notion of the end-Holocene to Heidegger's thinking about the 'end' (*Volendung*) of modernity or metaphysics, where 'end' is understood as 'consummation.' The notion is emphasized strongly in Heidegger's Nietzsche lectures from the late 1930s. There are indeed some intriguing connections between the two concepts, and I do make some reference to the notion of consummation below, but a full examination of the issues here would take us too far afield.

9. Thus Stephen Gardiner has argued that the age of climate change is best characterized as the confluence of three ‘storms’: the global, the intergenerational, and the theoretical. The last of these three is what I have in mind here. See Gardiner 2011.

10. Excellent critical discussions of these ideas can be found in Cronon 1998 and Vogel 2015, chaps. 1–2.

11. I thank an anonymous reviewer for this journal for raising this point.

12. An accessible account of biomimicry can be found in Benyus 1997. An excellent philosophical discussion of the concept can be found in Blok 2016.

13. For example, the Canadian government—the same one that led the charge in Paris 2015 for a 1.5° C limit on global warming—has approved the construction of three pipelines carrying tar sands oil from Alberta to tidewater for export.

14. Obviously the 1.5° C target puts even more strain on the supply of these reserves.

15. Paul Crutzen first got people talking about geoengineering in a serious way. In what follows in this section I focus on the recent book by Morton, which is really an elaboration of Crutzen’s main ideas. See Crutzen 2006; Morton 2015.

16. It is worth emphasizing that the subtitle of Crutzen’s original intervention is, “A Contribution to Resolve a Policy Dilemma.” In my view, it is the rush to make policy before we fully grasp the full complexity of the issues involved that has distorted our thinking about geoengineering.

17. Heidegger put the point this way in a seminar held in Le Thor in 1969. See Capobianco 2010, 18.

18. Tracing the connections between the concepts of the ontological difference and presencing in Heidegger’s philosophy would require a paper unto itself. And though there is some dispute about the role played by *Anwesen* in the early philosophy it is indisputably central to Heidegger’s later thought. Juan Pablo Hernández has argued that *Anwesen* becomes a key term in Heidegger’s philosophy in the early years of the 1940s, and he makes the connection to the ontological difference explicit: “the necessity to pay heed to the ontological difference—central to Heidegger’s philosophy since the early period—is formulated in terms of the necessity to fully grasp the understanding of Being as *Anwesen*” (Hernández 2011, 230).

19. Capobianco argues that for Heidegger “the Greeks experienced the ‘overabundance’ and ‘excess’ of the appearance or presence of beings. The resided generally ‘in the midst of phenomena and philosophy . . . was born of the overwhelming wonder about this overwhelming thrust of presencing” (Capobianco 2010, 18).

20. It is crucial to note the language of *appearance* in this passage, however. For Heidegger goes on to say, “in truth, however, precisely nowhere does man today any longer encounter himself, i.e., his essence. Man stands so decisively in attendance on the challenging-forth of enframing that he does not apprehend enframing as a claim, that he fails to see himself as the pone spoken to, and hence also fails in every way to

hear in what respect he ex-sists, from out of his essence, in the realm of an exhortation or address, and thus *can never* encounter only himself' (Heidegger 1977, 27).

21. A good discussion of related issues can be found in Blok 2014.

22. I owe this felicitous phrase to an anonymous reviewer at *Techné*.

23. To be clear, these arguments are not sufficient to establish the permissibility of geoengineering. In my view, the bar for success with respect to sulphate injection, for example, must be set very high. Consider the problem of moral hazard, the idea that people behave recklessly when they feel themselves to be 'insured' against some danger. In our case, the belief that we have an effective cooling veil might cause us to think there is no danger from further greenhouse gas pollution. We might even be emboldened to increase our emissions in this case. For many reasons—most prominently the specter of increased ocean acidification—this would be a disaster. Although I don't have the space to argue for it here, my view is that we should therefore adopt a so-called 'portfolio' approach to geoengineering: a policy that combines targeted geoengineering schemes with aggressive spending on mitigation and adaptation.

24. There are too many complexities surrounding the concept of Gaia for me to analyze here. I am using the notion only in the deflated sense of the whole earth system. I thank an anonymous reviewer for this journal for challenging me on this point.

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