

GEOENGINEERING, THEOLOGY, AND THE MEANING OF BEING HUMAN

by *Forrest Clingerman*

Abstract. Because of the lack of a meaningful international response to global warming, geoengineering has emerged as a potential technological response to climate change. But, thus far, little attention has been given to how religion impacts our understanding of geoengineering. I defend the need to incorporate theological reflection in the conversation of geoengineering by investigating how geoengineering proposals contain an implicit anthropology. A significant framework for our assessment of geoengineering is the balance of human capability and fallibility—a balance that is at the center of theological and religious interpretations of the meaning of the human condition. Similarly, geoengineering challenges our past understandings of theological anthropology.

Keywords: anthropocene; climate change; ecotheology; geoengineering; hermeneutics; technology; theological anthropology

News reports and international scientific assessments make clear that climate change is a pressing issue. Yet we face political gridlock, personal unwillingness to modify habits and lifestyles, and a hesitation to make the necessary radical changes to social structures. What are we to do? Perhaps out of desperation or due to our confidence in human technological prowess, the lack of a measured answer to global warming has led to more extreme proposals. One such proposal is geoengineering (sometimes called climate engineering), the possibility of large-scale human technological manipulation of the climate in order to forestall temperatures associated with catastrophic global warming. Over the past decade, geoengineering has gone from fanciful science fiction to the pages of academic journals.

Although geoengineering has captured the attention of climate scientists, ethicists, and policy analysts, scant attention has been given to how *religion* and *theology* impact our understanding of geoengineering. This is unfortunate, because this lack of religious reflection results in a distorted understanding of the impact geoengineering might have. Furthermore,

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this lack limits our ability to assess how climate engineering currently is understood by society. Theology—broadly speaking, critical reflection on ultimacy, meaning and the sacred as these are manifested in existence—has much to say about geoengineering, and much to learn from it. In fact, theological reflection can uncover a wide variety of positions related to geoengineering, from a clear condemnation to a cautious acceptance (a spectrum described in more detail elsewhere; see Clingerman 2012). In order to promote further reflection on this subject, the present essay addresses one of the most important areas in which theological reflection should have a voice in the geoengineering debate: the interpretation of the nature of being human, or what can be identified as philosophical and theological theories of anthropology. Climate engineering challenges us to rethink our sense of being human in ways that have profoundly theological implications. I wish to show that *a significant framework for our assessment of geoengineering is the balance of human capability and fallibility—a balance that is central to theological interpretations of the meaning of the human condition*. My investigation contains two parts. First, I argue that geoengineering proposals entail an implicit interpretation of our humanness. Second, I argue that theological reflection offers an important frame through which to understand the anthropological underpinnings of geoengineering, while simultaneously geoengineering raises new challenges for contemporary theological anthropology.

GEOENGINEERING AS A QUESTION OF BEING HUMAN

The first step to my argument is to see why the debate surrounding climate engineering is not simply about technical feasibility or scientific knowledge, but instead entails a claim about human self-interpretation. Specifically, geoengineering can be understood as a manifestation of a particular hermeneutical interpretation of human existence.

What is geoengineering? A basic definition for geoengineering comes from the 2009 British Royal Society report: “the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change” (Royal Society 2009, 1). This definition eliminates climate effects caused by unintentional human action, as well as projects aimed at changing regional weather.

To explain this definition further, we can elaborate on David W. Keith’s comment that “[s]cale and intent play central roles in the definition” of geoengineering (2000, 247). On one hand, geoengineering proposes a novel form of human environmental intervention due to the scale involved. Jacob Haqq-Misra comments, “[t]he ability for humans to use technology to modify their environment on a global scale is unprecedented in the history of life on Earth. Although climatic changes, such as the rise of atmospheric oxygen nearly 3 billion years ago, have occurred in Earth’s history, humans

are the first organisms that can deliberately and collectively manipulate their home planet” (Haqq-Misra 2012, 985). Geoengineering, then, follows the historical progression of human intervention that began with agriculture and animal domestication, but it is qualitatively different in light of its more comprehensive and invasive impacts. On the other hand, what is truly unique is that geoengineering projects seek to *intentionally* alter global climate systems. The deliberateness of geoengineering is essential for understanding its uniqueness because “[o]therwise we are geoengineering right now: burning fossil fuels changes the atmosphere’s chemistry. To reduce fossil fuel combustion might be geoengineering because it is deliberately changing the chemistry of the atmosphere from what it was going to be . . .” (Schelling 1996, 304). Geoengineering proposals purposely seek mechanisms to gain control over—or at least minimally to direct in some way—the climate systems of the Earth, with the goal of negating the worst effects of global warming. The scale and intention involved differentiates climate engineering from other human feats, even though we can still acknowledge that the technical and scientific ability to embark on this type of planetary experiment is an extension of the human ability to manipulate the environment more generally.

There is no single technical paradigm for geoengineering proposals, even though all share the same goal of global temperature reduction. The variety of proposals that have emerged can be divided into two categories. On one hand, some proposals focus on the reduction of greenhouse gases currently in the atmosphere, thereby lowering the rate that the planet retains or absorbs solar energy. Primarily these proposals are attempts to recapture carbon dioxide—thus these methods are classed as “carbon dioxide removal” (CDR) or “industrial air capture” methods. These methods include methods that enhance or mimic natural processes: massive reforestation, iron fertilization of the ocean, artificial “trees,” or large-scale scrubbers to capture carbon dioxide. Although such methods are not necessarily tied to any reduction of emission of carbon dioxide, they do seek to maintain a certain level of greenhouse gases, and thus presumably will limit the environmental effects related to greenhouse gases. Such methods introduce other environmental effects, however. For instance, iron fertilization schemes would have significant effects on marine ecosystems and ocean chemistry.

On the other hand, some proposals are oriented toward reducing the amount of sunlight absorbed by the planet; these methods are referred to as “solar radiation management” (SRM). Arguably, SRM can be subdivided further: some proposals attempt to increase the planetary reflectivity, or albedo, whereas others seek to reduce the amount of solar radiation that actually hits the Earth. Thus, SRM proposals vary greatly, from painting roofs white to thousands of small-scale space mirrors placed between Earth and the Sun. The most commonly discussed SRM proposal is the

introduction of particles in the atmosphere to increase albedo (for further analysis, see Rasch et al. 2008). Compared to CDR, SRM proposals are frequently economically cheaper (in some cases cheaper than the reduction of initial emissions or adaptation), as well as faster in their effects. Further, they rely on novel applications of current technology rather than the invention of new technology. However, SRM has drawbacks not present in CDR: “[w]hile SRM may be relatively cheap and fast, it is also imperfect” (Morgan and Ricke 2010, 5). SRM also does not alleviate the problems of increased carbon dioxide in the atmosphere, meaning that these proposals are more technologically invasive and also do not mitigate for things such as changes in plant growth, the effect of carbon dioxide on the oceans, and the like.

Although proposals for geoengineering schemes have a long history, it has only been in the last decade or so that climate engineering has emerged from the shadows to be considered a possible mainstream response to anthropogenic climate change.¹ Two articles published in 2006 mark a symbolic “tipping point” in the geoengineering debate, especially since the subsequent responses to these essays have moved the topic of climate engineering from a small group of scientists to the broader intellectual arena of climate policy and environmental ethics. The first article was by Paul Crutzen (2006), who advocated research into the injection of sulfur into the atmosphere to mimic the 1991 “Pinatubo event.” Crutzen’s essay was pivotal because he, as a Nobel laureate and coiner of the term “Anthropocene,” persuasively offered a justification for the need to *debate* human technological intervention in the global changing climate.

The second article, by climate scientist Tom Wigley, was similarly influential. Like Crutzen, Wigley (2006) was pessimistic about the adequacy of our current regimes to respond to climate change. Due to the magnitude of the problem and current inaction, he argued that mitigation alone was insufficient, although he also showed that mitigation is necessary to avert excessive ocean acidification and other problems. Instead, Wigley argued that a combination of mitigation and geoengineering must be seriously considered in order to overcome the gridlock concerning policy, the technological problems surrounding mitigation, and the potential catastrophic impacts of temperature rise. He proposed an integrated approach: “Mitigation is therefore necessary, but geoengineering could provide additional time to address the economic and technological challenges faced by a mitigation-only approach” (Wigley 2006, 452).

The arguments of Crutzen and Wigley suggest a turning point in our approach to anthropogenic climate change. This turn is not limited to the assessment of the technical feasibility of climate engineering, although both Crutzen and Wigley address this. More importantly, the arguments presented by Crutzen and Wigley attempt to introduce a more nuanced reflection on ethical and social implications of “hacking the planet” to a

broader audience. Unintentionally, these authors raised questions about the human role in managing the planet's resources, and about our self-image as seen through the technological mediation of the environment. While they do not explicitly address these concerns, their provocative discussions of climate engineering imply the need to *radically revise our understanding of being human in the world*. Quite simply, geoengineering has an implicit theory of anthropology.

To draw out the repercussions of this implicit theory, we can turn to theology. In many respects, theologians offer a number of resources to address an important question: If climate engineering implies a revision of our sense of being human, what vision of humanity does it offer? In fact, the model of human being that emerges from climate engineering is best understood by detecting the differences in anthropological insights found in an anti-geoengineering stance compared to those found in the positions of geoengineering proponents. On one side, critics of geoengineering define the human in terms of limitation and arrogance—a stance that has strong resonance with many positions found in the theological tradition. From this one might argue that global warming is the result of the fallibility of the human being. As clearly shown by our environmental “sins,” we are already unwitting and inept manipulators of the climate, and geoengineering is seen to be an extension of the corrupt worldview that caused anthropogenic climate change in the first place. From this perspective, any attempts to curb global warming with a “techno-fix”—a frame Dane Scott (2012) explored in relation to geoengineering—must be approached with skepticism and derision.

Such suspicion culminates in what Christopher Preston characterizes as the “presumptive argument” against climate engineering.² In many versions of the presumptive argument, science identifies an objective understanding of “how the world works” in its supposedly “natural” state. The consensus position on climate change, thus, is accepted as an objective description and normative definition of “the climate” (a problematic claim that Mike Hulme has investigated in depth; see Hulme 2009). Using this supposedly objective scientific description of climate change, environmentalists transform the supposedly passive certainty of the change of the “*natural*” into the need for *political, ethical, and worldview* change. Thus, the presumptive argument against geoengineering leads us to see how politics and ethics are to be considered pragmatic tools through which to adapt to the natural climate system, while science is the passive but omnipotent director of these mechanisms.

I suggest that the suspicion of the anti-geoengineering stance is built upon a complex and perhaps even contradictory understanding of what it means to be human (note that while it might seem logically contradictory, this understanding has a powerful and important existential force, especially in how it focuses our self-interpretation on aspects of

humanness that invariably ring true). This anthropology emphasizes the finitude of human knowledge against a backdrop of the progressive ideal of our ability to know, the recognition of the fallibility of our actions, and our culpability in past fossil fuel use. Furthermore, a great deal of value is placed on the need for prudence and humility, lest we fall into a moral hazard and use geoengineering as an excuse to do nothing. Therefore, the anti-geoengineering stance advances a sense of the human as a steward who must maintain the separation of the natural and the artificial; in this state of “betweenness,” we see that human knowledge is fragmentary, our abilities are situational, and thus our responsibility is inevitably provisional and must be marked by humility. Yet this betweenness creates a dilemma: if we are to foster the “natural,” it is only because we start apart from mere nature—for good and for ill.

Thus, the implicit anthropology of an anti-geoengineering stance sees humans as strangely *un/natural* beings. The natural world and its climate functions independently of and transcends humanity, who are left to integrate themselves imperfectly through a culture that is a danger to the natural world. And in this light, the self can be defined in response to the changing climate in ambiguous terms. We must scientifically learn about the world to ameliorate our destructive tendencies, while at the same time we must not presume to have overarching control or transcendent responsibility. And so because we unwittingly influence the climate, the way forward is through a chastened ethical lens: Do we have the moral authority to seek to control “the domain of the gods,” to evoke Simon Donner’s (2007) insight that the sky is traditionally beyond humans and under the control of the divine? For many, the answer is an unqualified “No,” because human beings are not created for such a task.

What, on the other hand, is the anthropology that emerges from proponents of geoengineering? Fascinatingly, proponents of climate engineering have a similarly complex and contradictory perspective on the human condition. This position also places humans “in between,” but interprets this placement as a reflexive engagement with the world. Proponents see geoengineering as the use of science and technology to actively *redefine* or *recreate* the natural, instead of a mere passive observation of nature. In this sense, humans are defined through the active mediation with their surroundings, and it is somehow only natural to accept our capacity to “humanize” the atmosphere. Thus, geoengineering renders the distinction between artifice and nature indistinct in an effort to undertake a restoration of the planet. This view acknowledges that the climate is unavoidably influenced by human actions, and can be manipulated in significant and global ways by humanity. And furthermore, since we already influence and manipulate the climate, then it is prudent to self-consciously and humbly define the terms in which we are meant to assert control. More provocatively, climate engineering does not simply alter the climate, but productively

alters the definition of humanness, insofar as climate engineering proposals *reflexively situate the self in one's climate*.

While this might appear surprising, proponents do not appear to be arguing for this reflexivity as a forceful domination of the environment, although geoengineering is undoubtedly an extension of the human desire to master nature. Instead, the mastery of the climate is unwillingly accepted as necessary to overcome the previous mastery of nature. Geoengineering is argued as a form of transforming our environmental failures through an ever more radical humanization of nature. In a contradictory fashion, geoengineering becomes an attempt to reintegrate humans with the global environment, not by redefining the human self in terms of being “natural,” but by rendering the climate a domesticated participant, as it were, in such human betweenness. Geoengineering proponents combine what they deem to be chastened self-responsibility with intellectual confidence; geoengineering thus paradoxically places humans in the position of intentionally exerting an all-encompassing control in order to release the planet from a hitherto unintentional mastery. Whether morally acceptable or not, geoengineering proposals rest on this type of reflexive mastery, this humanization of the climate.

In describing this reflexivity, geoengineering proponents interpret climate engineering as something other than hubris—it is a redefinition of how we interact with the world in the “Anthropocene era.” The term “Anthropocene” was coined by Crutzen (2002a, 2002b) and Steffen et al. (2007) to characterize the pervasive changes to the globe brought on by human activity, particularly population growth and fossil fuel use. But climate engineering takes this one step further, adding an element of reflexivity to the Anthropocene—that is to say, in climate engineering we are not only changing the globe, but we are *knowingly* planning and implementing the Anthropocene era. Preston describes the changes that climate engineering brings to the Anthropocene clearly: “If anthropogenic warming ended the era of untouched nature, then [solar radiation management], in some powerful sense, begins the era of global artificing” (Preston 2012a, 191).

By transforming the Anthropocene with human reflexivity—by *making the choice* to humanize the very atmosphere of existence and thereby *self-consciously enter* a new geologic era—the very definition of humanity changes. Climate engineering becomes more than just a technical fix; it is the occasion for a new model of our place, of our relation to the nonhuman world, and of the human being itself. Galarraga and Szerszynski (2012) seem to have this in mind when suggesting that climate engineering puts humans on course to be “makers” of the climate. As makers of the climate, we shape and mold the world system in ways never before attempted. That is to say, whereas humans have always manipulated local environments, and even unintentionally changed large-scale (even global) systems, climate engineering redefines the possibility of changes, and this necessitates a new

model of humans in relation to the world. They write: “Such technological interventions would, in an important sense, be making the climate. The very definition of geoengineering means that it is intentional and planned; the full-scale implementation of [solar radiation management] would thus result in a climate that was an artifact—a climate that has not just been *disturbed* by human intervention but has been *intentionally shaped* by human intervention” (Galarraga and Szerszynski 2012, 221).

As Galarraga and Szerszynski argue, to be makers of the climate—whether as architecture, artisan, or artist—is riddled with ambiguity. Crutzen, too, points out such ambiguity in his description of the Anthropocene when he writes, “Hopefully, in the future, the ‘*anthropocene*’ will not only be characterized by continued human plundering of Earth’s resources and dumping of excessive amounts of waste products in the environment, but also by vastly improved technology and management, wise use of Earth’s resources, control of human and domestic animal population, and overall careful manipulation and restoration of the natural environment” (Crutzen 2002a, Pr10–4). The reflexivity and intentionality of climate engineering creates a situation in which the world is humanized—or even overhumanized, which questions the morality of such proposed interventions into the atmosphere. Proponents of climate engineering assign this role with fear and trembling, and yet continue to forge ahead. And thus the need for a new approach to modeling the human being in the world comes from an ambiguous shift of our place as makers, from the haphazard disruption of the environment to the intentional and total re-creation of the world in our image.

GEOENGINEERING, THEOLOGY, AND THE SELF

As we have seen, the debate surrounding climate engineering moves beyond ethics and technical feasibility, to the point of addressing human self-understanding. *Any interpretation of climate engineering implies a sense of who and what we are.* The next step, therefore, is to draw out this implicit anthropology by asking: How can we effectively bring together the tensions and uncertainties of who we are in the midst of an engineered climate? I suggest that this task is best completed by theological reflection. In fact, I wish to argue that theology and climate engineering are mutually transformative: theological reflection provides a framework for understanding the anthropological dimensions of climate engineering. At the same time, theological reflection is challenged and changed by the reflexivity of geoengineering.

Framing the Self in an Engineered Climate. How might theology change the discussion surrounding climate engineering? By presenting us

with a *meaningful frame* through which to interpret the implicit anthropology of geoengineering.

The topic of framing global warming has received much attention, as a response to the lack of action in ever increasing certainty of the consensus model of climate change. Frames offer a context and meaning-structure to direct one's interpretation. In the words of Spence and Pidgeon, "A frame allows complex issues to be pared down and for some aspects of that issue to be given greater emphasis than others in order that particular audiences can rapidly identify why an issue may be relevant to them" (Spence and Pidgeon 2010, 657). For instance, Mike Hulme (2008) has suggested three different frames are in use when understanding our fear of climate change: judgment, pathology, and catastrophe (see also Nerlich and Jaspal 2012). Similarly, Cheryl Hall points out the uneasy extremes of hope and despair that often are used to frame environmental issues such as climate change (Hall 2013; for a theological response, see Clingerman and Ehret 2013). Dane Scott (2012) has investigated some of the frames that are used specifically in the case of geoengineering, including seeing geoengineering as an insurance policy or Plan B, and as a technological fix. In these examples of framing environmental issues, frames are not static, but changeable. Thus, Matthew Nisbet persuasively argued for the need to *self-consciously* define our frames, saying "[s]uccessfully reframing climate change means remaining true to the underlying science of the issue, while applying research from communication and other fields to tailor messages to the existing attitudes, values, and perceptions of different audiences, making the complex policy debate understandable, relevant, and personally important" (Nisbet 2009, 14).

I wish to argue that theology provides us with the tools to construct a more coherent frame for understanding how we are transformed by geoengineering. In this sense, the discussion of framing shares much in common with the task of theological modeling as proposed by David E. Klemm and William Klink, among others (Klemm and Klink 2003; Clingerman 2009). While the philosophical literature on the topic provides us with significant tools for a better understanding of who we are and who seek to be, something is missing: namely, a sense of the *depth* of the self, as the *unity* of ourselves as creatures who are simultaneously destructive and creative, prideful and guilty, fearful and hopeful. As Kierkegaard famously wrote, "A human being is a synthesis of the infinite and the finite, of the temporal and the eternal, of freedom and necessity, in short, a synthesis" (Kierkegaard [1849] 1980, 13). The self is a unity of contraries, and this sentiment is at the center of our quest for spiritual meaning as found in human religious traditions. Thus, *our sense of who we are as intentional makers of the climate is not simply a philosophical question, it is also a religious and theological one*. Given that the debate over geoengineering has exposed a conflict of interpretations and discordant meanings of who we are,

I suggest that the interpretation of the self, as rendered by geoengineering, can only be resolved through a theological model. After all, critics of climate engineering ask: “Can we play God?”—such a question pinpoints how deeply climate engineering is embedded in both human self-interpretation and theological reflection.

In suggesting that geoengineering posits a theological dimension of the self, I am not limiting theology to reflection on traditional religious dogmas or institutional settings. Rather, I am assuming a broader sense of religion, characterized as the experience of the substance, wholeness, and depth of existence. Religion is centered on what Paul Tillich called “ultimate concern” or what David E. Klemm and William Schweiker more recently identify as “. . . the human longing for and awareness of the divine (what is taken to be unsurpassable in importance and reality) experienced and expressed within the concrete cultural life of particular historical traditions” (Klemm and Schweiker 2008, 152). Defined in this way, religion includes our institutions and traditions, but is not limited to them. Because of its pervasiveness as the center and organizing ideal of life’s meaning, religion is essential for our human self-understanding. In turn, theological reflection—systematic thinking about one’s ultimate concern—has ramifications on how we structure our understanding of existence, our actions in the world, and our interpretation of being human—the basis for what is termed theological anthropology.

Defined by the relationship between the self and one’s ultimate concern, the topic of theological anthropology is not limited to questions of salvation and redemption. More generally, theological anthropology includes religious reflection on the formation of human being in the midst of the tensions of human existence. The concrete impact of theological anthropology, therefore, is to serve as a framework through which to interpret any human mediation of the world. Nowhere is this clearer than in our discussions of climate change and geoengineering—both of which are names for the peculiar mediation of human existence in our current time and space. As theologian Sigurd Bergmann has noted, religion is important to our understanding of how we are changed by the climate: “If the ‘earth, our home’ shall remain a habitable place for all to live, spiritual perceptions, perspectives and practices with and within it seem in such a perspective to be crucial for the development of new modes for creative adaptation in a changing environment” (Bergmann 2009, 110). Taking a step further, theological reflection is important because it is able to ask otherwise neglected questions: how do we understand the intentional mediation of climate engineering from the position of human fallibility? How should we understand the possibility of our salvation from climate catastrophe, if redemption comes from our own capacity for technical manipulation of the entirety of creation? Is the humanization of the climate essential for human flourishing, and for the advancement of what Klemm and Schweiker

term “the integrity of life before God?” What is the synthesis needed to discover the depth of meaning of the self in an engineered world? When we intentionally make the climate, might we better understand who we become by “narrating ourselves” through religious symbols and myths?

Questions such as these show the importance of theologically *framing* climate engineering. Along those lines, I suggest that there is a significant theological frame for interpreting geoengineering: *the human as the self-conscious, fragmented balance of capability and fallibility*.³ At its most basic level, “A human self is a concrete, specific person in community with others, seeking to live out a life of love within the complexities and realities of existence” (Klemm and Schweiker 2008, 67). Due to the realities and possibilities of existence, theological reflection can explore the human being as “in between,” and balanced between the tension of human *capability—intellectual, moral, technological, spiritual, and otherwise*—in light an inevitable *fallibility* of humanity. This is akin to what Immanuel Kant called our “original predisposition to the good” versus our “propensity for radical evil” (Kant [1793] 1996). That is to say, “[h]umans are fallible beings who can turn and fall away from their highest good” (Klemm and Schweiker 2008, 70). But at the same time, we are creators and makers, seekers of the Good, and (in the Abrahamic traditions, at least) “in the image and likeness of God.” We see ourselves as not only corrupt, material beings, but as creatures who are created for a relation to the divine and the Other. “To be a human self . . . is to find oneself in another, in God, and always to surpass self in the free struggle for the cultivation of character marked by love of others” (Klemm and Schweiker 2008, 61). To be a self is to live between good and evil, or as Luther preached, as simultaneously sinner and saved.

Acknowledging this polarity reorients our conception of geoengineering, uncovering the ways the two sides of the debate (critique and acceptance) together form a human narrative of fear *and* of hope, intertwined. Rather than simply a question of technology, risk, or prudence, the attempt to assess how to intervene in large-scale natural processes can be interpreted as an attempt to live “in between,” or as a manifestation of how humans live in a precarious balance between good and evil. Or, perhaps, climate engineering is an attempt to reflect on both sides of these poles simultaneously, as a confrontation of past guilt and expectant hope in human existence. Theologically, then, climate engineering is framed through the inevitable tensions of imperfect finitude and a hopeful sacred relationship with the Other.

To make such claims more concrete, we can reflect on how climate engineering would be a self-conscious *work* of human being. As David Jensen has suggested, one theological model of human work (among others) is the idea of humans as cocreators (a term more extensively investigated by Philip Hefner). Jensen writes, “Created in God’s image, human persons

can work in ways that preserve their dignity as workers or in ways that promote suffering and toil. Despite work's ambiguity, the creativity and ingenuity of work contribute something to creation. God summons human workers to take part in the redemption of the world" (Jensen 2006, 39). But we also must acknowledge a danger: calling humans cocreators "... may inadvertently emphasize the agency of the creature at the expense of the Creator... Cocreativity implies a cooperation that is often not present in human labor: most of the time we do not align our work with God's creativity" (Jensen 2006, 39). If climate engineering is an embodiment of human self-understanding, and finite human self-understanding is always contextualized into a sense of "the whole," then the work of geoengineering subtly becomes the dilemma of how to express the desire to cocreate with God without falling into the all-too-human danger to work outside the meaning of Divine creativity. Do geoengineering proposals form an example of human cocreation in God's work, or are such proposals limited to human purposes? Will we be altruistic makers, laboring in love for the Other, or be self-absorbed, toiling out of misplaced love? Is climate engineering an attempt to transcend our own finitude and "save ourselves," or a confession of guilt in the face of our own fallibility? Is "control of the global thermostat" an arrogant desire to remake the world in our image—a domineering mastery—or can we actually release the world from human domination through a paradoxical act of the human capacity of reflexive, technological mediation? Such questions are rooted in the very meaning of being human. By viewing climate engineering in a theological frame, such questions open us to a new sense of selfhood expressed in the reflexive anthropology of climate engineering. This does not necessarily resolve the narrow ethics of geoengineering, but instead it provides us with the framework to better grapple with the many questions raised by geoengineering on individual and social levels.

Adapting Theology to Geoengineering. While theological reflection provides a useful frame for understanding climate engineering, at the same time *climate engineering provides a challenge to our theological conceptions of the self.*

Theology, a manifestation of human culture, is historical and perspectival. As a critical reflection about faith, our theological formulations are altered by intellectual, physical, and spiritual contexts. Sigurd Bergman and Dieter Gerten persuasively argue that the force and impacts of anthropogenic climate change influence religion and theological reflection. In the words of Bergman, "climate change changes religion, its practices, ideologies, and images of God and the sacred" (Bergmann 2009, 103). Bergman further argues that we must adapt to a changing climate not simply through physical or political changes, but also with the recognition that one's religious understanding emerges from one's climate. In a similar

vein, Peter Scott has pointed out that theology must interrogate how climate change and humanity are intertwined. This interrogation does not leave theological reflection unchanged, but instead redefines theological reflection in more materialist ways. Scott writes, “Climate change is not something to be set over against the human; neither is it the revenge of nature nor the mask of a wrathful god. The event that is climate change is rather admonitory feedback that surges toward us out of the goodness of creation: it is the quality of nature that nurtures, but under a minus sign; it is the goodness of creation, but under the sign of the negative” (P. Scott 2011, 61–2). Seeing the goodness of creation in this way is the mark of our times, and as such it impacts our theologies. That is to say, insofar as religion is a historical force of human meaning, it continually responds and adapts to the human context, location and climate—and only through such adaptation can theology provide resources for understanding the climate change.

If climate change changes religion, certainly the same claim extends to climate engineering. The difference between the two is the intentionality and reflexivity of climate engineering, which seeks a correlation to a fully reflexive theological thinking. As a research program and a technological mediation, geoengineering is a reflexive engagement with climate change: it is a manipulation that intentionally seeks to uncover a new balance between the human capacity to change the climate and the fallibility of human models of the climate system.

Therefore, climate engineering challenges religion, I suggest, because it is a human desire to wholeheartedly and intentionally “play God” with the climate. The reflexivity of climate engineering admonishes us to approach theology with a similar reflexivity, forcing us to question what it might mean to “play God,” and even how the human manipulation of the climate might become an absence of the sacred, which allows us to more acutely identify the Divine in our midst. To put this succinctly: climate engineering changes religion, insofar as it *desires* to gain control of the global thermostat and thereby to paradoxically render the world natural once more. It presents the opportunity to theologically reflect on a world that must accept that *someone* controls the Earth’s thermostat, even if we ultimately choose not to use this control.

Gerten’s example of the impact of the hydrologic cycle on religion shows this well. He writes, “The hydrological and other biophysical impacts of climate and environmental change in different corners of the world will have profound cultural and symbolic impacts, for example in that familiar places, lifestyles, identities, and religious rituals may get irretrievably lost” (Gerten 2010, 49). Gerten argues that the hydrological impacts of anthropogenic climate change will alter and transform religious ritual and belief; because of its effect on water cycles, climate change changes religious practice and doctrine. What does geoengineering add to this dynamic? As is

well known, many of the consequences of geoengineering involve changes in hydrology. For instance, one of the areas of concern regarding climate engineering is the fact that SRM proposals do not mitigate for ocean acidification. In addition, SRM projects will change rainfall patterns and monsoons, even if successfully controlling the global mean temperature. There is an important difference between the changes Gerten outlines in case studies, and the changes that are forecasted in geoengineering models: the intentionality and choice of undertaking the wholesale management of the climate. Insofar as climate changes religion, in other words, climate engineering seems to indicate a willingness to undertake responsibility for the ways climate changes will change religion. By accepting such hydrological changes, we do not simply “write the weather” (Szerszynski 2010), but explicitly become the authors of religion as well. This leads to a warren of introspection: we reinscribe the ways climate writes religion, and religion inscribes its climate, and we humans are inscribed and then reinscribed by both.

To conclude, this form of reflexive, intentional change is nowhere more apparent than in the domain of theological anthropology. If theological anthropology is a framework through which to engage geoengineering, then another hitherto neglected dimension of discussion is how commonly accepted views of theological anthropology should be intentionally *reconstructed* or *adapted* in response to climate engineering. While not acknowledged in the technical appraisals of geoengineering, in other words, an inevitable result of the enactment of climate engineering would be a transformation—a re-engineering—of the theological climate. A constructive theological model of geoengineering posits that climate engineering is best encountered as more than a technological fix for climate change, but instead as a secularization and an atmospheric materialization of theological anthropology. In essence, geoengineering asks of us: Who have we become, and in the current climate how might we promote a meaningful integrity of life in its redemptive possibilities?

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NOTES

1. There are a few overviews of geoengineering, such as Keith (2000). To understand some of the policy and legal issues, see Michaelson (1998). One of the most discussed forms of climate engineering is the use of aerosols in the atmosphere, as discussed in Rasch et al. (2008). Robock (2008) summarizes a number of the issues concerning critics of geoengineering. Recently, the ethical issues have been prominently discussed in a collection of essays edited by Christopher Preston (Preston 2012b).

2. "In all of these cases, the presumption central to environmental ethics is that human actions need to be circumscribed in such a way that human-independent processes are left largely intact. . . . Climate engineering creates biogeochemical processes that are artificial (in the Aristotelian sense of embodying human intention). Given the central environmental intuition, this could form a *prima facie* reason, or a presumptive argument, for opposing many geoengineering projects" (Preston 2011, 464).

3. Such a balance has an analogy in theological reflection on climate change, as seen in Clingerman and Ehret (2013).

REFERENCES

- Bergmann, Sigurd. 2009. "Climate Change Changes Religion: Space, Spirit, Ritual, Technology—Through a Theological Lens." *Studia Theologica* 63:98–118.
- Clingerman, Forrest. 2009. "Seeking the Depth of Nature in a Scientific World." In *Technology, Trust, and Religion: Roles of Religions in Controversies on Ecology and the Modification of Life*, ed. Willem B. Drees, 141–56. Leiden, The Netherlands: Leiden University Press.
- . 2012. "Between Babel and Pelagius: Religion, Theology and Geoengineering." In *Engineering the Climate: The Ethics of Solar Radiation Management*, ed. Christopher Preston, 201–19. Lanhan, MD: Lexington Books.
- Clingerman, Forrest, and Verna Marina Ehret. 2013. "Hope and Fear: The Theological Side of Framing Environmental Change." *Ethics, Policy and Environment* 16:152–55.
- Crutzen, Paul J. 2002a. "The 'Anthropocene.'" *Journal de Physique IV* 12:PR10-1–10-5.
- . 2002b. "Geology of Mankind." *Nature* 415:23.
- . 2006. "Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?" *Climatic Change* 77:211–19.
- Donner, Simon. 2007. "Domain of the Gods: An Editorial Essay." *Climatic Change* 85:231–36.
- Galarraga, Maialen, and Bronislaw Szerszynski. 2012. "Making Climates: Solar Radiation Management and the Ethics of Fabrication." In *Engineering the Climate: The Ethics of Solar Radiation Management*, ed. Christopher Preston, 221–35. Lanham, MD: Lexington Books.
- Gerten, Dieter. 2010. "Adapting to Climatic and Hydrologic Change: Variegated Functions of Religion." In *Religion and Dangerous Environmental Change*, ed. Sigurd Bergmann and Dieter Gerten, 39–56. Munster, Germany: LIT Verlag.
- Hall, Cheryl. 2013. "What Does It Mean to Be Green? Envisioning Positive Possibilities without Dismissing Loss." *Ethics, Policy, and Environment* 16:125–41.
- Haqq-Misra, Jacob. 2012. "An Ecological Compass for Planetary Engineering." *Astrobiology* 12:985–97.
- Hulme, Mike. 2008. "The Conquering of Climate: Discourses of Fear and Their Dissolution." *The Geographical Journal* 174:5–16.
- . 2009. *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity*. New York, NY: Oxford University Press.
- Jensen, David. 2006. *Responsive Labor: A Theology of Work*. Louisville, KY: Westminster John Knox Press.
- Kant, Immanuel. [1793] 1996. "Religion within the Boundaries of Mere Reason." In *Religion and Rational Theology*, ed. Allen Wood and George Di Giovanni, 39–215. New York, NY: Cambridge University Press.
- Keith, David W. 2000. "Geoengineering the Climate: History and Prospect." *Annual Review of Energy and Environment* 25:245–84.
- Kierkegaard, Søren. [1849] 1980. *The Sickness unto Death*. Princeton, NJ: Princeton University Press.

- Klemm, David E., and William Klink. 2003. "Constructing and Testing Theological Models." *Zygon: Journal of Religion and Science* 27:495–528.
- Klemm, David E., and William Schweiker. 2008. *Religion and the Human Future*. Malden, MA: Wiley-Blackwell.
- Michaelson, Jay. 1998. "Geoengineering: A Climate Change Manhattan Project." *Stanford Environmental Law Journal* 17:73–140.
- Morgan, M. Granger, and Katharine Ricke. 2010. *Cooling the Earth Through Solar Radiation Management: The Need for Research and an Approach to Its Governance*. Geneva, Switzerland: International Risk Governance Council.
- Nerlich, Brigitte, and Rasi Jaspal. 2012. "Metaphors We Die By? Geoengineering, Metaphors, and the Argument from Catastrophe." *Metaphor and Symbol* 27:131–47.
- Nisbet, Matthew C. 2009. "Communicating Climate Change: Why Frames Matter for Public Engagement." *Environment* 51:12–25.
- Preston, Christopher. 2011. "Re-thinking the Unthinkable: Environmental Ethics and the Presumptive Argument against Geoengineering." *Environmental Values* 20:457–79.
- . 2012a. "Beyond the End of Nature: SRM and Two Tales of Artificity for the Anthropocene." *Ethics, Policy and Environment* 15:188–201.
- , ed. 2012b. *Engineering the Climate: The Ethics of Solar Radiation Management*. Lanham, MD: Lexington Books.
- Rasch, Philip, Simone Tilmes, Richard P. Turco, Alan Robock, Luke Oman, Chin-Chieh Chen, Georgiy L. Stenchikov, and Rolando R. Garcia. 2008. "An Overview of Geoengineering of Climate Using Stratospheric Sulphate Aerosols." *Philosophical Transactions of the Royal Society A* 366:4007–37.
- Robock, Alan. 2008. "20 Reasons Why Geoengineering May Be a Bad Idea." *Bulletin of Atomic Scientists* 64:14–18.
- Royal Society. 2009. *Geoengineering the Climate: Science, Governance, and Uncertainty*. London, UK: The Royal Society.
- Schelling, Thomas C. 1996. "The Economic Diplomacy of Geoengineering." *Climatic Change* 33:303–07.
- Scott, Dane. 2012. "Insurance Policy or Technological Fix?" In *Engineering the Climate*, ed. Christopher Preston, 151–68. Lanham, MD: Lexington Books.
- Scott, Peter Manley. 2011. "Thinking Like an Animal: Theological Materialism for a Changing Climate." *Studies in Christian Ethics* 24:50–66.
- Spence, Alexa, and Nick Pidgeon. 2010. "Framing and Communicating Climate Change: The Effects of Distance and Outcome Frame Manipulations." *Global Environmental Change* 20: 656–67.
- Steffen, Will, Paul J. Crutzen, and John R. McNeill. 2007. "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?" *Ambio* 36:614–21.
- Szerszynski, Bronislaw. 2010. "Reading and Writing the Weather: Climate Technics and the Moment of Responsibility." *Theory, Culture and Society* 27:9–30.
- Wigley, T. M. L. 2006. "A Combined Mitigation/Geoengineering Approach to Climate Stabilization." *Science* 314:452–54.