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CLIMATE ENGINEERING IN THE NEW MEDIA LANDSCAPE: CULTURE, POWER, AND CLIMATE CONTROL

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Abstract: Climate engineering, or geoengineering, is large-scale technological intervention in the global climate system. How is this understood within our culture, what power relations are implied in the idea, and what are geoengineering's implications for sustainability? This thesis begins to examine this topic through the lens of culture by presenting a media analysis. It combines the quantitative method of content analysis with qualitative methods of discourse analysis to examine how geoengineering is represented in the popular media, and discusses the implications of these representations for governance. In particular, the thesis examines how representations of geoengineering function in the landscape of new media, and how these representations might enable or disable public participation in geoengineering decision-making. After the dominant narratives by which we understand geoengineering are identified, the thesis discusses the historical and social construction of these narratives and how they might be changed to incorporate visions of a climate that is both democratically decided upon and sustainable.

Keywords: geoengineering, climate engineering, discourse analysis, narratives, catastrophism, securitization of climate change, media content analysis

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1. Introduction

1.1 Topic

Culture, power, and sustainability: these three concepts are entwined threads in our current dilemma of how to address climate change. It is arguably an increasingly global consumer culture which inhibits the transformation of our political-economic systems to sustainable ones: climate change is a cultural problem. But these cultural norms, attitudes, and values are shaped by a complex of powerful interests. It is through a desire to work out and bring to light some of these power relations that I have chosen the cultural representation of climate engineering as the topic for my CPS master's thesis. Climate engineering, or geoengineering, is commonly defined as large-scale technological interventions in the climate system. If human ecology is the study of the factors which influence human-environment interaction, then geoengineering is a topic of great interest to human ecology. Climate engineering represents a conscious, calculated attempt to intervene in the environment at a global scale. So, a human ecologist might ask: what cultural factors influence how we conceive of and carry out this global intervention?

1.2 Purpose of the study

My intent in this study is to contribute to these vast questions within human ecology by studying a smaller issue: in what context is geoengineering culturally acceptable, and how is it portrayed in the media? I am interested in the power dimensions of media portrayals: my premise is that differing media portrayals can imply differing forms of governance.

Climate engineering would in theory affect every organism inhabiting the planet. Thus, many people believe that there should be public participation in climate engineering decision-making. An initial question, then: how do decision-makers invite public participation on an issue the public knows next-to-nothing about? Social scientist Anthony Leiserowitz added a question about geoengineering to his latest climate change poll, and found that 74% of respondents had never heard of geoengineering—and only 3% of the respondents had a correct idea about what it actually is (2010a). As Leiserowitz told scientists gathered for an international geoengineering conference at Asilomar, "Americans know nothing about geoengineering. The first impression, frame, and narrative has yet to be set" (2010b). And of course, which cultural understanding of geoengineering is set could have serious ramifications for how sustainable our society is fifty or a hundred years from now. The fear of many anti-geoengineering activists is that if geoengineering is accepted as the only, or the best, "solution" for global warming, business-as-usual may continue on for some time to come, with all of the fossil fuel industry's inequalities and socioecological impacts. On the other hand, proponents of geoengineering research fear that in a worst-case scenario, geoengineering could be the only way to stabilize a rapidly warming world, and a delay or ban on research could condemn millions— especially the most vulnerable— to catastrophic climate change, thus jeopardizing the stability needed to build a sustainable future. In either case, geoengineering may have impacts on sustainability. Given it is the cultural understanding that will allow geoengineering research to be funded or to be banned, it is very important that we understand the factors and influences that are shaping how understandings of geoengineering are constructed.

Part of my purpose in undertaking this thesis is to provide insights that might guide policy-makers. In a recent closed-door briefing, a lead U.S. climate negotiator commented on the paucity of social-science geoengineering research: it has become my observation and opinion that policy-makers have no clear idea how to treat this issue, preferring to keep it on a shelf. I have submitted my governance recommendations regarding geoengineering and public participation to the Solar Radiation Management Governance Initiative, in a collaboration with philosophy professor Christopher Preston. I have also contributed to a white paper on the ethics of solar radiation management facilitated at a workshop I attended at the University of Montana, and have tried to keep the policy recommendations geared towards those audiences. Another audience for parts of this project has been climate scientists themselves, some of who have commented on presentations of this work. I consider it a secondary or tertiary purpose to offer scientists new ways of thinking about the media, the publics, and how to relate to them. It is my conviction that academic research should be relevant to a wider community; hence, I have selected a topic that can be of service in this critical time, when a governance regime for geoengineering has yet to be set.

1.3 Research questions

This particular study, which is comprised of a content analysis of both print newsmedia and online content, addresses two basic questions. First, who has voice or authority in current media treatment? Second, how is geoengineering framed in the news media? That is, what interpretive storylines emerge that suggest boundaries for how to think about the issue? Through studying authority and framing, I hope to glean some insight how these stories write the audience into the text—how they position the reader—which could lay the groundwork for a discussion of how media portrayals enable specific forms of governance. Can there be a media space for public participation in geoengineering conversation and decisions? Examining how the media space looks now will help us assess how the media can become a better habitat for public discussion of climate engineering.

2. Analytical framework

2.1 Literature Review

In true human ecology style, this thesis required me to delve into the literature of several fields, especially since there is slim social science literature on geoengineering. Hence, much of my information was derived from directly talking to the researchers who are shaping this field as it grows. Below, I will briefly trace the history of geoengineering literature (largely in the natural sciences), and then comment on the influences from other fields which informed this thesis.

Geoengineering has its roots in the post- World War II period of increased climate research. There are two currents within post-war era science that feed into today's concept of geoengineering: a growing awareness of climate change, and efforts at weather modification. These began as two different research fronts within a military-scientific system, and the lines of research only began to converge in the 1970s. Weather modification is a term most commonly associated with cloud seeding (the aerial spraying silver iodide or other chemicals into clouds to produce rain). However, weather modification encompassed a wide range of imaginative ideas. Grandiose visions from the Soviets included removing Arctic sea ice to warm Russia, and injecting metallic aerosols into orbit to form rings, which would give Russia heat and light (Keith, 2000: 251). In the US, there was interest from both the military and from commercial ventures. The main activities during the beginning of the 1950s were focused on farm production and carried out on a relatively small scale.

Yet military imagination was also at work. As General George C. Kenney, commander of the Strategic Air Command, proclaimed: "The nation that first learns to plot the paths of air masses accurately and learns to control the time and place of precipitation will dominate the globe" (cited in Fleming, 2006: 10). Military agencies undertook endeavors like Project Stormfury (research on hurricane control), Project Climax (research on increasing the Colorado snowpack), and the National Hail Research Experiment (designed after hail suppression work in the USSR). In 1957, however, the state took federal action: weather modification officially left the military domain and was brought under the auspices of the National Science Foundation by a Congressional act: the Water, Cloud Modification Research Act (Kwa, 2001: 140) This researched became merged with work on the behavior of the global atmosphere, and the academy was finally included; the emphasis was placed upon modeling. The NSF was spending almost as much on "weather modification" as on all the rest of the atmospheric sciences combined by the 1970s (ibid).

During the post-war era, weather modification research was not yet linked to research on climate change (Kwa, 2001: 152). In 1970, only about 1 percent of government research monies for weather modification went to programs investigating inadvertent human modification of the climate (President's Council on Env Quality, 1970). Eventually, research on climate change did make it into formal agendas. David Keith marks the first high-level government policy assessment describing the CO2-climate problem as Restoring the Quality of Our Environment, a report done in 1965 by Johnson's Science Advisory Committee (2000: 254). It mentions a strategy for changing the earth's albedo by dispersing reflective particles upon the ocean's surface, and fails to mention the possibility of reducing fossil fuel use (Ibid.). Subsequent reports by the National Academy of Sciences continue to research climate change, though they do not always include geoengineering on their agendas.

It is during the 1970s that climate modification to combat global warming truly gains attention for the first time. In 1974, Kellogg and Schneider published an article in Science called "Climate Stabilization: For Better or for Worse?" which sketches the basic idea of geoengineering as it exists today— mentioning schemes for creating stratospheric dust layers, eliminating Arctic sea ice, damming the Gulf Stream, etc. The article goes on to suggest mechanisms for distributing the burden of the effects, such as insurance. In 1977, Cesare Marchetti is the first to bring the signifier "geoengineering" into the conversation, in an article in *Climatic Change* entitled "On Geoengineering and the CO2 Problem."

These ideas, however, simmered very quietly and were more or less fringe notions throughout the 1990s, despite the work of a few researchers and scholars like Steven Schneider, Thomas Schelling, and famed H-Bomb father Edward Teller. (David Keith's 2000 article "Geoengineering the Climate: History and Prospect" remains an excellent history and overview of geoengineering during these decades; see also Fleming.) It was not until Nobel laureate Paul Crutzen published a "Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolved a Policy Dilemma?" in *Climatic Change* in 2006 that the topic went mainstream. The weight of a Nobel prize-winning climate scientist led other climate scientists to take the topic seriously, and ignited some controversy among the community. Caldeira and Wood (2008), Rasch (2008), and others began to publish models and theoretical overviews in scientific journals.

The 2009 report by the U.K.'s Royal Society, *Geoengineering the Climate: Science, Governance, and Uncertainty;* brought the topic into the field of vision for both policy-makers and the media. On one hand, economists like Bjorn Lomborg, Lee Lane of the American Enterprise Institute, and Dubner and Leavitt of *Superfreakonomics* fame spoke up to advocate geoengineering research. More cautious voices emerged from some climate scientists, including Alan Robock's 2008 piece, "20 Reasons why geoengineering may be a bad idea." The testimonies generated for the U.S. House of Representatives Committee on Science and Technology during 2009-2010 by Jane Long, Ken Caldeira, David Keith, and numerous other climate scientists offer a range of perspectives on the issue. Science writers and journalists also started to take up the topic to a wider degree. Mass-market nonfiction titles like Jim Fleming's *Fixing the Sky* (2010), Eli Kintisch's *Hack the Planet* (2010), Jeff Goodall's *How to Cool the Planet* (2010), and Gwynne Dyer's *Climate* Wars (2008) all serve to explain the issue to publics at large.

Within economics, Nobel economist Thomas Schelling has done significant work on geoengineering (1996, 2009); see also Barrett (2008) for a laudatory article on the "incredible" economics of geoengineering. Juan Moreno-Cruz, Kate Ricke, and M. Granger Morgan are currently working on the economics of geoengineering in an interdisciplinary context. In political science, David Victor's work (2008, 2009) offers an understanding of geoengineering in a geopolitical context; see also Virgoe (2009). Beyond the scope of geoengineering, John Dryzek's work on deliberative democracy and climate justice (2010) and Fishkin's ideas about public consultation (2009) also informed this thesis.

With regards to philosophy and ethics, Stephen Gardiner's 2006 paper and 2009 paper are key readings. Gardiner explains the "perfect moral storm" that leads to the climate conundrum where geoengineering might be used, and explains the "arm the future" argument: that we should do research in case we need geoengineering in the future, otherwise we won't even have the option to use it. Dale Jamieson's 1996 paper on the ethics of intentional climate change is also a foundation piece to this debate, and still relevant. I also used the work of Beck (2010), Latour (1993, 2008), Proctor (2009), Brand (2009) and Hajer (1995, 2009) who write about climate, development, modernity, and narratives. Jerome Bruner's work on narrative and cognition also influenced this paper, as did the work of discourse analysts like Fairclough (1995) and Dryzek and Niemeyer (2008). Within geography and environmental ethics, I drew often from Harvey (1999) and Hulme (2008). Media theorists like Silverstone (2007), Sunstein (2001), Poster (2001), Mosco (2005), and Carey (1992) are all valuable in understanding how media has changed and what those changes mean for democracy. Though I am only briefly mentioning these scholars in this literature review section, their contributions to this work will become evident as we move throughout the thesis.

2.2 Theoretical background

This thesis applies discourse analysis and a media focus to see geoengineering as a cultural construct. That is, geoengineering is not yet an idea that exists in any applied sense; it is a "thing" which exists only in the imaginative realm of catastrophic news stories and computer models. Arguably, the time of its physicality may be nearing: but as of yet, it is a mental, and thus cultural, construct. Possibly, a construct designed and deployed with conscious intent by vested power interests to maintain a status quo (though this is argued by some anti-geoengineering activists, I have yet to see compelling evidence that this is the case). But it is part of the theoretical framework of this thesis to identify power relations behind the different iterations and representations of this imaginative construct, geoengineering. Though these theoretical perspectives are sometimes applied outside of the academy (see Bronson, 2009), this thesis is one of the first to emphasize the narratives at work in geoengineering, and the first to analyze the media representations. The thesis delves into both new media theory and theories of public participation and deliberative democracy; hence, both these theories will be elaborated in this section, and key concepts like the "general public" or "audience" will be critically challenged.

2.2.1 Media concepts

1) **Media is an environment.** The media sphere is where humans interact, especially in the "developed" world, where we have developed a world with very little actual public space for interaction. As Deuze observes, "living a liquid life involves a complex dance between work, play, and life in the context of a rapid-changing 'glocal' environment, in which life gets enacted in and through media" (2007: 42). Throughout this thesis, I employ Roger Silverstone's concept of the *mediapolis*: "the mediated space of appearance in which the world appears," where we are constructed as human (or not), and where public and political life emerges (2007: 31).

2) **This environment is interactive, but that doesn't make it equally authored.** Digital media is no true "public sphere", à la Habermas; as Silverstone puts it, "the world is shareable but not necessarily shared" (2007: 27). Communications scholars make proclamations like "screens will be not only the window to our world, but also our *second front door*," (Van Dijk, 2006: 194); it is often intimated that we are stepping into a brave new interactive world: rhizomatic, democratic. Yet while digital code is a beautiful technology that allows us to manipulate, write, and rewrite the media, the mediapolis is still shaped by the hands of large corporations: those who own the literal infrastructure of backbone cables and data farms, those who create the code of the programs we use, those who host and organize the content, and those who produce much of the content. The power to interact is molded by many hands before it gets handed down to the consumer/ creator/ end-user.

3) **Media produces both content and audiences as commodities.** Media sells content (texts, images, video) as commodities, but audiences are also made into commodities and sold to advertisers. This is a fairly obvious point, but it often goes unnoticed. Media exists to *form* us as

much as *inform* us; as a formed and formulated audience with specific known tastes that can be sold to advertisers, we become profitable. Ask a circulation manager or audience development department at any publication or website who "the public" is, and they will probably have very specific ideas about just who the public who reads *their* publication is. How does the creation and selling of audiences influence coverage of geoengineering? A trial assumption could be that it can influence the angle of the stories being told. Certainly, the media-influenced fragmentation of "the public" into a multiplicity of publics does have implications for democratic politics, as far as it limits a true public debate, perhaps even a public reality (see Hajer, 2009; Sunstein, 2007; and Papacharissi, 2002). While the collective term "the public" is used occasionally throughout this thesis, it is more as a *goal* than an actually-existing entity.

4) **Both media texts and audience have an active part in making meaning.** When we experience media, should we describe ourselves as audiences, users, consumers, prosumers, citizens, participants? Where is the agency? I believe the agency is shared. The "empty vessel" perspective is as passé in media studies as it is in education—few believe that humans are blank slates to be injected with media—but neither are the readers/watchers/participants completely free to construct their own interpretations; the author is not dead.

Social scientists studying climate change communication have faced difficulties trying to employ the "information deficit model," which presumes that "the public are 'empty vessels' waiting to be filled with useful information on which they will then rationally act" (Ockwell et al, 2009: 321). Geoengineering will likely suffer from the same communication difficulties as climate change in general, until we alter the model of thinking about the challenge.

5) **Communication serves a ritual function.** The transmission view of communication has to do with the Euroamerican legacy of colonization, geographical expansion, and conquering distance—communication once equaled sending a telegram. The ritual view of communication, however, views communication as being grounded in ideas of sharing, participation, and communion (Carey, 1992). Hence, using media isn't just about transmitting information: it consists of us

telling stories about ourselves. This is particularly fascinating when considering geoengineering: what function does it serve within our culture to share these stories about climate?

6) **Media doesn't just relate events, it also performs them.** It represents the world, but also enacts social relations and identities (Fairclough, 1995: 15). This is explored by Beck, who writes that "the news media do not only function in terms of a global focusing of events; rather, the news media adopt a more performative stand, actively enacting certain issues as 'global risks'" (2010: 261). This is especially relevant with geoengineering, which is often staged as the insurance policy for climate risks.

7) **Language can create conceptual changes.**

There are certain opportunities that living in a mediapolis affords us for rapid societal change. A new concept, given life by a word, can spread quickly: "geoengineering", while not a freshly minted word, has almost done this. Imagine talking about "geoengineering" without the signifier "geoengineering": for one, vastly different approaches like biochar and aerosols in the stratosphere would probably not be lumped together in the same news article, and so "geoengineering" would not have the dread-inspiring gravitas that it does.

New terminology and new metaphors don't just reflect changing realities; they create shifts in the narrative, open the way for shifting realities, make change possible. Language doesn't simply innovate to accommodate the new ways of seeing the world—it plays an active role in creating new views. There is not enough space to fully elaborate this point here, but it is fundamental to understanding what is going on with public perceptions of geoengineering.

2.2.2 Public Participation

One of the five principles that academics from Oxford, University College London, and Cardiff came up with is "public participation in geoengineering decision-making" (House of Commons, 2010: 29). A first basic question, then: Is public participation even possible? Any attempt to involve the public now runs into the problem of also having to inform and perhaps form the public, so let us hope that familiarity with the idea of geoengineering will increase in the future. And while I want to shy away from this model that there are people "out there" who much be "reached" to grab their permission, there are material, infrastructural challenges to involving large portions of this earth— I mean this quite literally in terms of bad road conditions and low bandwidth. (And, of course, consultation is not the same thing as active participation in the process; democracy is more than going to the ballot box.[1]) Moreover, from a standpoint of general realism, it could flatly be impossible to make decisions on global environmental risks democratically. As Altvater writes, "The congruence of decision, concern, and control has gone. It is impossible to decide on the effects of the radioactive fallout from Chernobyl or the construction and use of the atomic bomb democratically in 'democracy's place'" (1999: 290).

Right now, the institutional structures for including true public participation in global political decisions are underdeveloped. But let us suppose, for the sake of exploration, that we *could* adequately face these challenges and create mechanisms for public participation in the future. In this section, we will discuss discursive representation as a possible avenue, and explore the ways in which new media could engage with these structures.

However, if we assume public participation is possible, we could ask a second basic question: Is public participation desirable? From my point of view, as someone brought up in a democratic system, this question has an instinctive affirmative answer. Yet I remember traveling in Bhutan, shortly after King Wangchuck had introduced elections for the first time, and talking to citizens who were dismayed about the introduction of democracy and the conflicts that come with it. Some were genuinely upset about all the new politicians arguing, and thought that things had worked more peacefully when the king took care of governing. Clearly, the analogies between a remote, Buddhist mountain kingdom and the entire planet are limited; I bring this up simply to make the point that democracy can be a slow, messy process that everyone might not agree on. If climate change is truly a matter of pressing urgency, then it is possible that by opening up geoengineering decisions to a wide public, states could be failing in their responsibility to protect citizens from climate change. Or, as James Lovelock recently claimed, "it may be necessary to put democracy on hold for awhile" (qtd. by Dryzek and Stevenson, 2010: 3). I don't happen to agree with that argument, but you can see how a simple premise like "public participation in decision-making is good" is actually quite complex— what if technocratic leadership is really in the interest of people?

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[1] It would be sad if the global north faced the same mistakes we often make in delivering aid when we try and "consult" people: i.e., coming in to a place, delivering some materials without understanding the social context, in which they would be used and then leaving. I won't elaborate this point here, but it is not impossible to imagine some kind of well-intentioned participation exercise that greets people who are on the periphery and leaves people them still on the periphery when it is over. (Can real participation even be designed?)

But let us work on the premises that public participation is both possible and desireable. In a classic piece about decision-making and environmental risks, Fiorino identifies three arguments against technocratic orientation. There is a substantive argument, which says that lay judgments about risk are as sound or more sound than those of experts— that nonexperts can identify issues, problems, and solutions that experts miss (1990: 227). A normative argument simply states that a technocratic orientation is undemocratic, and "accepts, as an ethical presupposition, that citizens are the best judge of their own interests." And an instrumental argument is that effective lay participation in risk decisions makes them more legitimate and leads to better results (1990: 228). Relating these three arguments to geoengineering, the normative argument for public participation probably has the most traction, and makes a good starting place.

I would like to note at the outset of our discussion the clear danger that public participation can be posited as bottom-up engagement when it is really top-down legitimation: as Bronson has warned, there is a "very high risk of co-optation" (2010). Stirling writes about the risk of instrumentality— that a public inquiry becomes an instrument for gaining public trust— and has an important observation: "Where the focus lies on a trusting participant (e.g., the public), rather than a trustworthy object (i.e., the specific technology or institution in question), then the instrumentalities become clear" (2008: 270). That is, "preoccupations with public trust can thus be a useful indicator of otherwise tacit instrumental perspectives" (ibid.).

2.2.3 Citizens, audiences, publics? Thinking critically about the "general public"

Since most people have not heard of geoengineering, we should not imagine that there is a "public" out there that is hostile to geoengineering: the case is rather that there are two small publics that are hostile to geoengineering, and a large public that is unaware. The two smaller publics I speak of are the people concerned with chemtrails (the idea that the government / clandestine entities are already deliberately spraying chemicals into the atmosphere, causing contrails to appear behind jets) and the environmental activists, who are in a few ways similar and in many important ways very different. They are similar in that they are skeptical of those in power, but the activists have credibility. In my view, there is also a large segment of people out there who have heard of geoengineering— people who read *Wired* or *Science*, tech-savvy and environment-interested people— who are vaguely skeptical of geoengineering, but skeptical for reasons of science, not ideology: i.e., they understand how complex the climate system is and generally think it is a bad idea to mess with it. These people are likely not going to go out and protest geoengineering, though they may follow the issue, and I would call them the "silent majority," or what Maarten Hajer might call "citizens-on-standby", with the observation that "a passive audience is only passive until it switches on" (2009: 180). When surveyed in an opinion poll about geoengineering, they might come up with similar answers to the other publics, but their worldview / interpretive storyline is much closer to that of climate scientists than to people who believe in chemtrails. Thus, I think it is vitally important not to conflate the different publics, as interacting with them may require different approaches. That may sound a bit strategic, but we are using communication strategies every day: I will speak to an elderly man in Beijing in a different manner than a teenager in Houston or a scientist in Boulder. My argument throughout this thesis is that we must use our full human range of adaptive communication skills when engaging with different publics; if information is presented in one way for an imagined monolithic public, all the other publics may be marginalized.

What is the relationship of scientists, policy-makers, and climate change communicators to these publics? I want to use the recently-released NERC report (*Experiment Earth? Report on a Public Dialogue on Geoengineering*, August 2010) as a point of departure for examining this. The first sentence of the executive summary begins, "'Experiment Earth?' was a public dialogue conducted for the Natural Environment Research Council (NERC) on geoengineering," which itself begs some questions— what will be the content of a public dialogue be "conducted" *for* an agency? The stated aim was to identify and understand public views on geoengineering research and deployment. However, to identify and understand public views, they had to in some sense create the views, because the public did not have much understanding of the subject to begin with (2010: 1). They informed the public through discussion groups with scientists (which may well have given them a different understanding of geoengineering than if they had simply encountered the topic in the media, and perhaps a better one). The exercises and presentations had stated objectives, like "Introduce idea of needing to trade-off relative pros and cons of different technologies", or "Get participants thinking about different questions relevant around governance, winners and losers, compensation, commercialisation" (2010: 72-73).

The difficulty of trying to "identify and understand public views on geoengineering", and at the same time trying to introduce specific ways of thinking about the issues, is obvious. Trying to tell people they need to trade-off pros and cons, and assess prospects for winners and losers, is encouraging a certain (rational, economic) way of thinking. If you gathered a group of people and "got them thinking" about different kinds of questions, you might well produce a different set of public views on geoengineering. When describing the "information given to participants", the report states that "Whether humans have caused this problem or not was outside the scope of the dialogue" (17). Suppose, instead, that you gave participants information about how carbon concentrations in parts per million have been rising since the heavy burning of fossil fuels in the 1800s and that they are pushing 400ppm, and you show them a graph of this, and inform them and that the link between burning fossil fuels and rising temperatures is probable. Suppose that you asked them what they thought were the causes of global warming were, and situated geoengineering in the context of the actual problem that geoengineering hopes to address. Or suppose that you gathered people together with not just scientists, but philosophers and psychologists, and asked them how they *felt* about geoengineering and nature-society relations. Suppose they created artistic or written visions of the future, and discussed spiritual views on the climate situation. The possibilities of how to "engage" with this issue are manifold: the point is that if you are giving people information, and encouraging ways to engage with the issue, it is difficult to then measure their "views." In Stirling's piece on the social appraisal of technology, he asks, "What is the purpose of structured exercises in participation? Are they about informing, or actually forming, the commitments themselves?" (2008: 267). How do we balance education with engagement and gauging perceptions? These questions are quite salient here.

The positioning of scientists, policy-makers, and the "public" is quite complex. The discussion events described in the NERC report were accompanied by open access events, in which people filled out 'Have your say' cards asking ‘What should scientists studying climate research be doing to save the environment?’ (2010: 13). This is a question asked by professionals about professionals. It intimates whose responsibility it is to be "saving" the environment— and also provokes matters of agency. The general tone of the report is that the people should be consulted, but that they do not have the responsibility or power to do much themselves. It is far from the substantive argument for participation that Fiorino suggests— we do not ask what expertise the public can add; there is no intimation that nonexperts can identify problems or solutions that experts miss, or that their participation makes the end result of things better in any way. The people are consulted, but not as collaborators.

One final point about the NERC report and how it imagines the public— there are dialogues between people described as "General Public" and "Scientist." I want to really challenge this idea of the "general public." The report made an attempt to include people with different views, genders, and ages (income level would have also been interesting). But that still does not mean that these individuals assembled make a "general public." In part, this may be a function of the postmodern media landscape: Poster argues that "the citizen, the intellectual, the democratic subject of the nation-state— these characters who fill the landscape of modernity were inconceivable without print" (2001: 13). But in the electronic technocultural landscape, the subject/object relation changes, so people don't have stable, centered identities, but fragmented and multiple identities (2001: 14). In postmodernity, nobody can be general. With the erosion of public space, and the erosion of the citizen, both "general" and "public" become unreliable terms. They are also nationally-based conceptualizations, and might have to be adjusted to consider global issues (what does a global general public look like?)

Despite this postmodern angle, I do believe that the various publics can be combined in a cosmopolitan vision. Moreover, the NERC report, despite my critiques of it, seems to be an honest start at public dialogue.

3. Research Methodology

Content analysis is the "systematic, objective, quantitative analysis of message characteristics" (Neuendorf, 2002: 1). Media messages are important to study, because they help create the climate for a discussion, and suggest boundaries for the discussion. By undertaking a quantitative content analysis of stories on climate engineering, I don't expect to find definitive numbers about all media ever generated on the topic. However, I do believe the sample is representative of English-language news media, and that some rough truths can be gleaned from this method. The sample consists of two parts, print and online. The print news media study collected articles from the Nexis UK Global News database, using the search strings "geoengineering" or "climate engineering" from the category "Major World Newspapers — English". Ninety-three of the 208 articles found are over 300 words and have three or more sentences pertaining to geoengineering. They span the years 1990-2010, though almost all of them were written in 2006 or afterwards.

The online media sample was compiled using Digg (www.digg.com), a site where users submit content from all over the web and other users vet this content for popularity. All content appears on the front page for a period. After the initial display, content with the highest number of votes rises to the top, thus using peer review to democratically and collectively select items users like best. Eighty-five text-based items which were rated over 8 points for the search strings "geoengineering" or "climate engineering" were selected. These are items which range from articles published from sources such as *Reader's Digest* online and the *Financial Times* online to blogs like *The Daily Green* and *Wired*.

My interest in drawing samples from these two sources is the idea that they represent two different (though interlinked) media ecologies. The first is a traditional broadcast media environment, where content is packaged with all other important "news" and the audience buys the whole package (whether or not they are interested in geoengineering). The second is an online media ecology where the audience has the power to choose which stories they like and want to read about; an environment in which there may be more freedom to write in-depth stories with different angles.

The content analysis examined various attributes:

1) **Trigger event** of each publication (is the story inspired by a politician's statement, the release of a study, a meeting of scientists, the release of a popular book?)

2) **Location** of both where the news is generated and where the news is published.

3) **Voices**: Who does the article cite, and what is their role? This attempts to directly investigate who has the authority to make assertions about geoengineering. Do some actors have more power to speak than others? Only the 71 news articles which were standard news articles

were coded for voice; the commentary and opinion pieces were omitted for this evaluation. The evaluation looked at each *assertion* or declarative statement made about geoengineering by a specific person or body (direct quotes or paraphrases of declarations); general statements in passive voice were not included.

4) **Frames**: "Frames are interpretive storylines that set a specific train of thought in motion communicating why might be a problem, who or what might be responsible for it, and what should be done about it" (Nisbet, 2009: 15). As Koteyko et al observe, "framing creates the boundaries around an issue and allows certain actors to claim ownership of it" (2010: 27). Which actors do the framings privilege, and how do the different framings write the audience into the text?

Climate change framing studies often divide texts into broad categories such as "progress" , "conflict and strategy", or "science fiction" (Nisbet, 2009; Weaver et al, 2009). This study looked at two distinct aspects of the frames employed: the *spatial* aspect and the *narrative* aspect. For the spatial aspect, I modified a framework used by Liu et al (2010), dividing the spatial dimension into five levels: individual, regional, societal (or national), international, and biospheric (articles in which the dominant frame is addressing the entire planetary system, rather than human societies or nation-states).

Narrative frames relate to which story is being told. After reading all the articles, I identified five dominant frames: catastrophic, managerial, cautionary, spatiotemporal struggle, and *bildungsroman*. This is of course a typology which I have identified— in some sense, it is then a typology I am arguing for— but it is a typology developed based upon quantitative research, so it has some empirical grounding. Four of these stories are the common stories being told about (or around) geoengineering; the fifth, the *bildungsroman*, is a story which I think has emergent potential.

Because many of the articles feature a combination of these frames, the articles were not neatly divided by frame: this would have been too arbitrary and artificially simple. Instead, I coded the presence of eleven discursive elements, which were identified by cues in the text.

Discursive element	Textual evidence that indicates this element	The story being told
crisis	Headlines like "Bombing the sky to save us from global warming" or "Can the ecohackers save us"?; phrases like "dangerous climate change" or "climate catastrophe".	The world / the planet / "we" are in urgent trouble and need to be saved.
inevitability	Headlines like "Life may depend on giant sunshade"; statements which give a sense of fatalistic likelihood to geoengineering, from strong inevitability "the world will need to suck carbon from the atmosphere to avoid permanent damage to the climate" (Pagnamenta, 2009) to more nuanced inevitability.	We have screwed up and now these climate engineering technologies may / will be necessary.
doubting our place	To be clear, there are many statements which express scientific doubt. Uncertainty is a part of science. Here, I have only included statements which doubt our *right*, or existential ability, to be doing climate engineering. Thus, any phrases about "playing God", "hubris", or "tinkering with Mother Nature" count, while statements conveying reasonable uncertainty about the consequences of such experiments aren't counted.	The planet is messed up because of technology, so technology can't solve this; humans aren't wise enough to mess with Mother Nature.
fantastic ideas	Headlines like "Wild and Crazy Ideas to Cool the Planet"; statements about "wacky" or "loony" ideas, either for entertainment appeal or to be derisive; mentions of "science fiction", "fantastic", or "futuristic" ideas.	Look at all these crazy / cool / spectacular ideas!
geopolitics	Headlines like "Global Climate Engineering: Who Controls the Thermostat?"; statements darkly warning about "rogue states" that are "difficult to restrain" by other "powers"	The world is a geopolitical game of strategy. Climate engineering will be used in this game of

		great powers.
justice	Headlines like "Who gets rich in a geoengineered world"; statements that give a justice dimension to the problem, either by questioning the actors, questioning the spatial impacts of geoengineering, or intergenerational issues, i.e. "Is it fair to leave this kind of burden and commitment to the next generations?" (Song, 2008)	There are winners and losers in geoengineering.
cheap solutions	Headlines like "Global Warming's Cheap, Effective Solution", statements like "It would be 100 times cheaper to shield the Earth from sunlight with a man-made 'sun block' than to cut emissions of greenhouse gases" (Connor, 2010). This evaluation doesn't count attention to cost (many articles feature cost estimates), but statements which are explicitly comparing the cost of geoengineering to mitigation.	It is cheaper to geoengineer than to cut emissions.
risks vs. rewards	Metaphors about geoengineering as "insurance", discussions of "rolling the dice" with our planet, talk of risks of both geoengineering and climate change.	"Life is about weighing risks" (Gorrie, 2008).
ecological modernization	Headlines like "It's a new route in drive to save the planet: motorways lined with synthetic trees"; statements like "in 200 years the earth will be 'an artifact', a product of human design" (Keith, qtd. by Dean, 2007), which create a vision of the future where the earth has become ecologically modernized, and is successfully managed. This discourse is admittedly hard to distinguish, since it is implied in the very idea of geoengineering— most stories contain a grain of it.	With cooperation and technology, we can make the future work. We can still develop and modernize, and take care of the planet, too: caring for the planet is a question of proper management.
science education	Any material which attempts to enhance the reader's understanding of science. Many stories relay facts; here only those which make a genuine attempt to explain the underlying concepts are counted.	Let me teach you about the science underlying climate engineering.
doctors & nurses	Metaphors with the earth as patient, geoengineering as "planetary medicine", statements like "we should be the heart and mind of the Earth not its malady" (Lovelock, 2008).	The Earth is sick, but maybe humans have the power to heal her.

4. Findings

4.1 Trigger events and geography of coverage

Geoengineering coverage, as anyone who follows the topic can intuit, has increased over the past few years, peaking with the release of the Royal Society report in September 2009. The topic is especially prominent in UK newspapers.

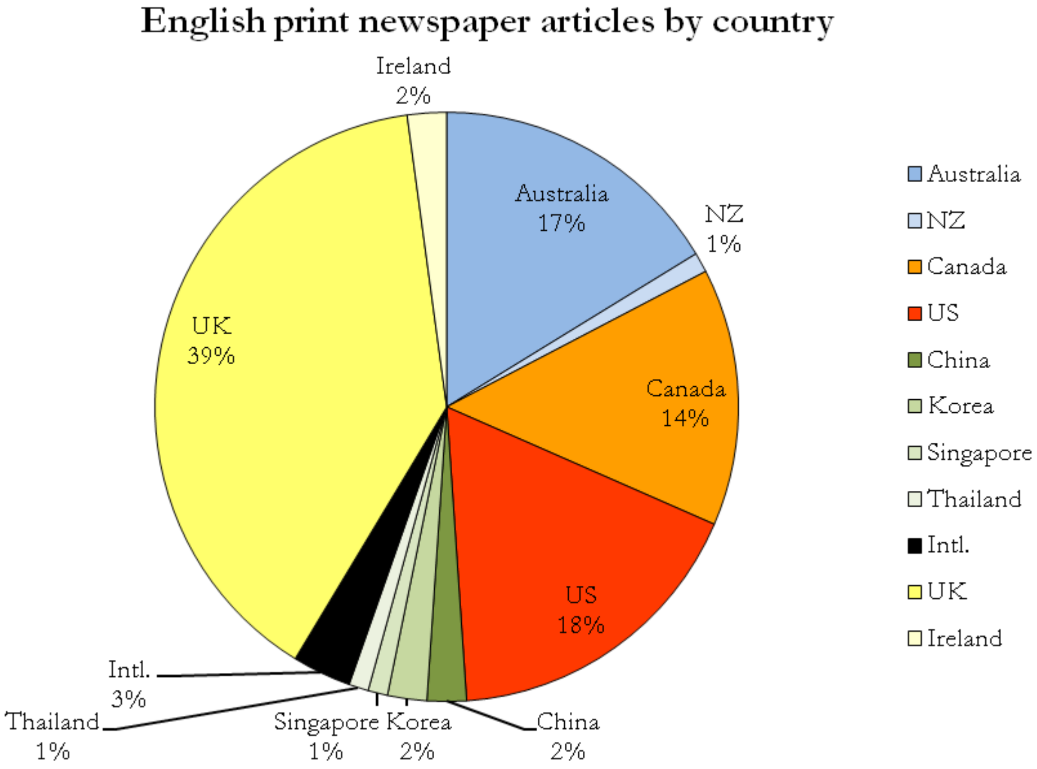

figure 1: English print newspaper articles by country

About ten percent of these stories were triggered by events in North America, 12% in Europe, and 25% with unclear trigger events (e.g. feature stories that ran somewhat independently of specific moments). At least half of the stories (49%) were triggered, however, in what I call the "mediasphere": the stories were written in response to publications, such as an article in *Nature,* or a book. In some sense, these *events* take place in a space which transcends borders —a realm of discourse or ideas. Geoengineering is not yet something that *happens* in the physical realm: it is enacted in this mediasphere.

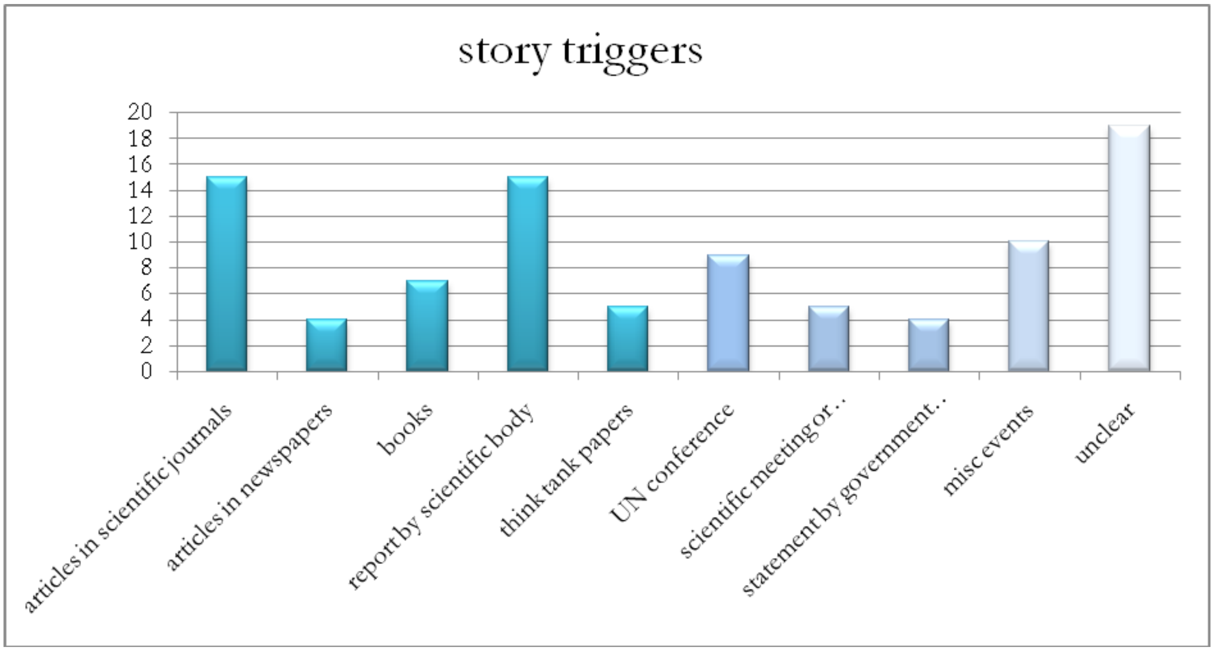

figure 2: Story triggers

4.2 Voice

In his book *Hack the Planet*, science writer Eli Kintisch refers to what he calls the "Geoclique": the network of scientists who are working on geoengineering. This geoclique, to borrow the neologism, is responsible for about 36% of the 500 assertions made about geoengineering in the 93 print articles.

Most-quoted geoengineering scientists		Other heavily cited people	
David Keith	9.4 % (47)	The Royal Society	6.4 % (34)
Ken Caldeira	6 % (30)	Stephen Chu	5 % (25)
John Shepherd	3.2 % (16)	Martin Rees	3.2 % (16)
Paul Crutzen	3 % (15)	J. Eric Bickel	1.8 % (9)
Roger Angel	3 % (15)	Lee Lane	1.8 % (9)
Alan Robock	1.8 % (9)	David Victor	1.6 % (8)
John Latham	1.8 % (9)	Bjorn Lomborg	1.6 % (8)
Mike MacCracken	1.6 % (8)		
Steven Schneider	1.6 % (8)		

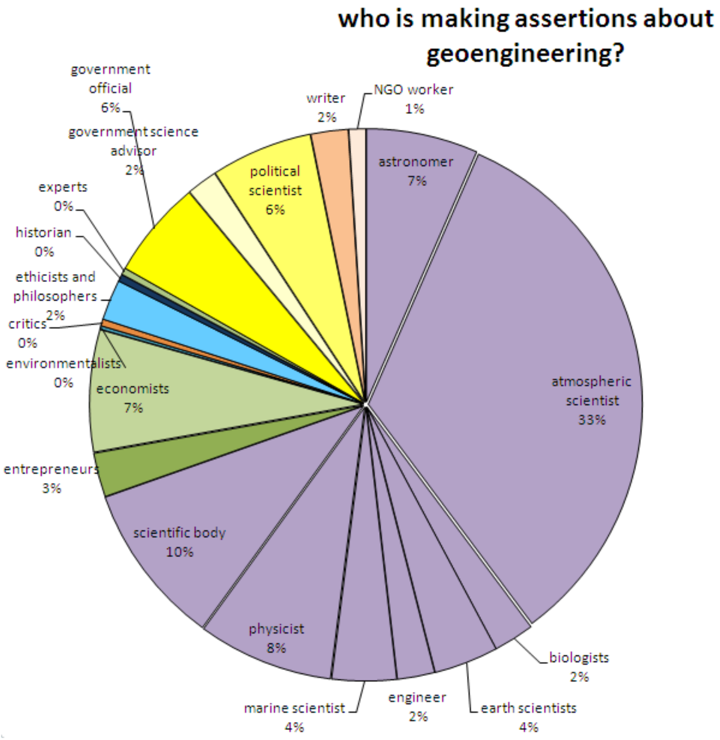

figure 3: Assertions about geoengineering

This figure tracks who is making assertions about geoengineering based upon how they are identified in the article (how the journalist has described them), and when a category of persons is listed as 0%, that is simply because Excel is rounding down. Notice that natural scientists and engineers together create 70% of the discourse on geoengineering, followed in much smaller parts by government officials and political scientists (14%) and economists (7%). By and large, it is voices in the scientific community who are making assertions about this topic. As asked by political ecologist Joan Martinez-Alier, with regards to environmental governance: "Who has the power to simplify complexity, ruling some languages of valuation out of order?" (2002: 271). Those who are speaking have the power to simplify complexity; it is in some crude sense those who have voice that have the power, the authority, the ability to author reality.

Who is not speaking? Well, citizens. Social scientists and philosophers are fairly unquoted on the topic, as well. There is little attention to geoengineering from a cultural perspective. Economists and politicians are also surprisingly quiet, given how prominent they are in Western society.

But the loudest silence, so to speak, is from women. Only three percent of assertions of geoengineering were made by women (15 statements). Furthermore, none of these statements were encouraging of geoengineering: all of them expressed skepticism or even hostility to the idea. Is this because there are simply less women scientists? Can we attribute the voicelessness to the media— perhaps it is simply not representing the women scientists who are out there, somehow? Or is it that geoengineering is a male project?[2]

4.3 Framing

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[2] [illegible] (2009) [illegible]

4.3.1 Spatial frames

Most stories are framed internationally. This is none-too-surprising, given the existing definition of geoengineering as large-scale. It also reflects what Hulme has observed about the universalization of the idea of climate: he argues that we have "detached it from its cultural settings" (2008: 9). Both the "de-culturization" of climate and the universalization of "the human plight" under climate change have implications for the governance structures that can be imagined. Further research could investigate whether individual, regional, or societal frames would increase public engagement with the subject.

print newspapers — percent of stories possessing this spatial frame		online content — percent of stories possessing this spatial frame	
individual	7 %	individual	1 %
regional	7 %	regional	0 %
societal	10 %	societal	15 %
international	88 %	international	93 %
biospheric	8 %	biospheric	11 %

* some stories use two frames, so the numbers don't add up to 100%.

4.3.2. Narrative frames

The most dominant frame has been the catastrophic frame: most journalists are telling a story about "saving the world." What does this signify? Is it "saving the world" simply a story with classic appeal?[3] Or do we actually believe that "the world" is in such grave danger?

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[3] [illegible] (1993: 114). [illegible]

	print newspaper stories	online media stories
Catastrophic	60 %	43.5 %
Ecological modernization	59 %	30.5 %
Risks vs. rewards	31 %	35 %
Fantastic Ideas	29% *	33% *
Inevitability	29 %	29 %
Doubt	24 %	23.5 %
Cheapness	21 %	12 %
Justice	12 %	23.5 %
Geopolitics	11 %	23.5 %
Science education	7.5 %	18 %
Doctors & nurses	6.50%	3 %

* of these stories, 33% of print stories and 25% of online stories present geoengineering as something which used to be "science fiction" or "far-out", but is now being considered seriously.

This emphasis on catastrophe seems to square with social science research on climate change attitudes. As of June 2010, about half of Americans are worried about climate change; 11% think it will harm their families and communities "a great deal", while 25% think it will harm their families and communities a moderate amount (Leiserowitz et al, 2010). In Europe, a Eurobarometer poll found that 67% of respondents thought that climate change is a very serious problem, and 65% believe that the seriousness of climate change has not been exaggerated (2009). So, despite a recent drop in belief in global warming (in America, anyway, see Pew 2009), the catastrophic frame is not out-of-line with how people are feeling. (Which came first, the media representation or the public sentiment?)

[illegible]

Print newsmedia and online articles are employing similar frames. Online stories were more likely to frame things in terms of justice or geopolitics, less likely to focus on the cheapness of geoengineering, and more likely to educate their readers on the science. Most of these slight differences between print and online stories, I attribute to narrowcasting—the fragmentation of audiences—and the on-demand nature of online media. People who read online stories are often seeking topics they are interested in, and they are often reading stories written for audiences interested in science or the environment. Potentially, narrowcasting could allow writers to go more in-depth in certain areas, but it also makes it difficult to have a wider public debate.

5. Discussion

These results could look rather dry: anyone who has read a few stories on geoengineering could guess that articles are framed in terms of saving the planet, managing the planet, and weighing risks and benefits. We reach richer material when we ask: What stories are *not* being told?

1. Despite the managerial framing and the elements of ecological modernization, almost nobody is framing this story with attention to the positive power of humans to transform their societies or environments. Humans, even when they are cast as fixers, are rarely protagonists. Even the stories which featured ecological modernization weren't exactly enthusiastic or positive: more often, they approached managing the earth as a chore, rather than a creative activity. The actors featured seem unable to act; if there is a protagonist, he is more a jaded, reluctant Hamlet than a Hollywood disaster-flick hero. We might have never been modern, but if the lack of enthusiasm about the human potential to transform the planet is any indication, we have definitely been postmodern. It is necessary to stabilize the climate to avert chaos—as Boykoff explains, "a guiding ethos of climate stabilization is the imagined future, safe, secure, stable climate, which can

be engineered by our actions now" (2010: 60)—but this stability is about averting the negative, not about establishing something positive.

2. Unsurprisingly, these stories tend to treat warming as the problem, and examine whether geoengineering is the potential answer. But rarely do we get a comprehensive look at the dilemma (by that I mean the extraction and burning of fossil fuels, though it could be extended to the wider dilemma of the socioeconomic system; see Foster, 1999; Kovel, 2002; O'Connor, 1998). Generally, the comprehensive nature of the dilemma is recognized with a few sentences, but it is not examined; the focus is elsewhere. A fairly typical article will mention that "the battle to contain emissions seems every day less winnable", and that geoengineering would be "a last resort because we couldn't curb our excesses" (Boyer, 2010)—yet the articles always muse within the bounds of this geoengineering topic. The question is, of course, how did those bounds come to be set? Can any topic have "natural" bounds? Because geoengineering looks at the waste disposal aspect of our energy woes, not the waste creation aspect, it would be easy to say the boundaries are inherent in the topic. An more material reason for the limited scope is the for-profit nature of the media system: in print media, each page is valuable "real estate." Hence, it's quite expensive to write an in-depth treatment of any problem. With online media, the limits aren't space, but attention span: it is hard to get engrossed in a computer screen, and hypertext makes for hyperactivity. There are few forms with mass appeal that can treat the issue with a wide scope.

3. The justice issue is seldom considered; even when it was present, it was rarely the dominant frame. Of course, it is hard to write about the justice aspects of specific geoengineering situations when the science is still so speculative. As for considering the justice aspects of geoengineering *as an idea*, this also requires a comprehensive look at our fossil fuel dilemma. The antagonist in the dominant frames is CO_2, which mundanely threatens everyone, making questions of justice invisible (see Swyngedouw, 2010: 222).

5.1 Bounding the issue

When we look at who is speaking in these stories, geoengineering becomes bounded as the province of experts. This is consonant with ecological modernization discourses, where the layperson is disqualified (Hajer, 1995: 10). As Hajer observes, "this disqualification in fact not only affects the proverbial man in the street: specialist natural scientists, politicians, philosophers, or social scientists, all experience how their stocks of knowledge and normative theories about proper procedural roles of reaching social agreements are devalued too" (Ibid.). We are all negotiating where our role and usefulness lies.

There are at least two ways of looking at the role of the individual reader:

1. *Educated chooser*: We are encouraged, in the ecological modernization discourse—especially where this risks versus rewards element is present—to weigh the risks and benefits; to make informed choices along with the people who are actually doing the decision-making. While the public is not invited to weigh in directly, we are presented the rudimentary information to make evaluative decisions. As consumers, we possess and use these decision-making skills daily, at least in the rational-choice model of economics.

2. *Spectator*: The topic is bounded as something which civil society should *keep watch on*, but the audience is written into the text simply *as an audience*, meant to observe while geoengineering matures into whatever it will become. NGOs have a role in this story (as vigilant watchers); often the ETC group is called a "watchdog." The state has a role: that of watcher (over*sight*), and a role which is expanded to that of protector, in the "strategic realism" of geopolitical discourse. Think tanks have a slightly more dynamic role; they can provide ideas-as-food for this growing project. The media is the stage upon which geoengineering is performed, and it also actively performs geoengineering. Scientists are ususally the stars. But the conflicts and characters take place *within* the scientific community; it's a self-enclosed dramatic system which usually provides the necessary dramatic elements without venturing into political landscapes. Civil society, however,

has an uncertain place in this story.

What could change this, and give the citizen more agency? A dismantling of this construction "geoengineering", which would smash these common survey approaches to the topic (e.g. "Ten crazy ideas to save the planet", with rendered graphics that depict all the geoengineering strategies at once, as if in an open market). Dismantling this construction would allow us to examine proposals which would have community, regional, or individual engagement. Local geoengineering is against the definition of geoengineering, but maybe we could think about adjusting this definition: or are we already committed to having birthed this strange chimera of techniques? The media coverage is dominated by a relatively small group of speakers, so I would argue that if there was the will to change the conceptualization of geoengineering, it could be done. Of course, if the international community were together enough to create funding for smaller carbon dioxide removal projects, we wouldn't need to be having this discussion: the sinister thing about the catastrophic-managerial geoengineering story is that it excludes idealism and possibility from the storyline. There may be no alternative. The story is based on the premise that we are in fact *incapable* of positive action. I would like to be absolutely clear that I am not arguing against the science which suggests that we are in a difficult climatic predicament: this is probably true. The focus here is on the narratives—the stories which we create out of this scientific data—and to whom they give authority; the forms of governance they may imply.

5.2 Narrative communication

What does the Nobel laureate Paul Crutzen, who proposed stratospheric aerosol injection in a groundbreaking article, have in common with the anti-geoengineering activists from the "Hands Off Mother Earth" (HOME) campaign?

Both have been motivated to act by a sense of despair about climate change. As Crutzen described in Heidelberg during a summer school about geoengineering in 2010, he put together his facts about what was happening with global warming, saw that mitigation measures were slow to take shape, and figured that geoengineering may be the only way avert biospheric disaster. The HOME activists felt despair at the ecological crises produced by industrial societies, perceived geoengineering experiments as a further threat, and became motivated to stop them.

There is actually shared emotional ground between scientists, activists, and other actors, but there is a divergence of storylines. People can assess the same set of facts, but because they have a different understanding of the plot and characters, they will come up with entirely different courses of action to take. Harvey's comments on environmental justice are salient here: "different designations as to who is the villain of the piece give rise to radically different explanations of both what is wrong, who is responsible, and what to do about it" (1999: 111). This is why it is vitally important to understand the narratives people are using to interpret scientific fact. It might seem counterintutitive to talk about stories with such a "scientific" topic, because *story* has the connotations of *tale* or even *falsehood*— but narratives are how humans make sense of the world.[4] When we make a statement like "We will, whether we like it or not, be faced with the decision of whether or not to do this over the next few decades, especially if the climate problem is worse than we think,"[5] there is a narrative implied there. There is movement through time, a plot which develops, a moment of climax— and people understand this. Likewise, the statement "I look at emissions reductions as trying to keep your house from catching on fire and these geoengineering schemes as a kind of insurance policy,"[6] also suggests a storyline with which we can comprehend what geoengineering would mean.

Narratives help people make sense of the scientific facts that describe the situation; as climate change communicators have found, facts without narrative are unlikely to engage people. The report from Yale climate scientists explains the problem:

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[4] As argued well by psychologist Jerome Bruner (1991).

[5] David Keith, quoted by journalist Vivian Song in *The Toronto Sun* (2008).

[6] Ken Caldeira, quoted by Mahoney in *The Globe and Mail* (2009).

> Rarely is there an anecdotal lead in a climate change story to drive the narrative and promote a sense of personal relevance, whether a likely victim of potential climate change impacts, an entrepreneur with a solution or a scientist- hero. Instead of human interest pegs, climate change stories tend to contain complex and abstract scientific information and follow a numbing structure: some event occurs (e.g., collapse of an ice shelf), the basic climate change science is spelled out, alternative explanations are offered, and the IPCC or some other authoritative source is cited, implying that more research is needed. These stories are sufficiently similar that the reader has little sense that the science has advanced (Abbasi, 2006: 122).

Can the narrative surrounding geoengineering be changed? Possibly, given how few people even know about geoengineering, and that the discourse is dominated by a scant handful of scientists.

The first step to shifting the discourse is simply to understand the existing narratives, and as found in this study, a dominant narrative is the catastrophic story. It echoes in some sense *the* major narrative, the mother of narratives: something is born, it grows old, it dies. Somehow, climate seems to be joined with this story to become the factor which hastens the end; and as in every good tragedy, there is something unwitting and poignant that ironically caused the end.

This story existed before climate, however. Rousseau wrote that "everything degenerates in the hands of men"; Nietzsche worried about the coming barbarism; the Frankfurt school lamented the fallen nature of modern man; even Al Gore wrote about our "strange Cartesian spell" and its effect on the world. The story here is familiar: there was a beautiful natural world, humans spoiled it; or, there was a beautiful culture / civilization, but now it is degenerate. The story is familiar because it has appeared in the Bible, in Fascism, in Romantic poetry, in postmodern critique. Perhaps the anguish that people feel about geoengineering is in some sense not specifically about geoengineering; rather, it could be about the final climax of this deeper story. Geoengineering is linked to a sense of loss— the lost nature, the lost connection to nature— and so it can be a profoundly emotional issue.

5.3 A way forward

The current narratives about geoengineering— that it is a reluctant choice we may have to make after failing to mitigate emissions; that it is an insurance policy we should invest in— are unlikely to galvanize public interest in any direction, because they are stories of failure, and of insurance. Furthermore, they do nothing to address justice issues, or the fundamental drivers of the climate change problem. What would make for a better narrative with which to understand geoengineering and its implications?

The common postmodern complaint should be addressed: that there is no universal narrative by which anything (or everything) can be understood— and that such a narrative, if it did exist, would be Eurocentric. This is a fair and important concern. However, I believe that it is an interesting exercise to sketch out a basic narrative shape that could have room for many storylines within it— especially since the Anthropocene indicates that we are a "civilizational community of fate," as Beck puts it (2010). We are, after all, members of the same species, and are there some traits, emotions, and behaviors which are broadly shared: humor, love, smiling, tool-making, expression.

Any successful narrative would necessarily be driven by basic elements which most humans are already concerned with, such as freedom or success. Here, it is worth mentioning Harvey's "gut response" to the question "Is a universal environmental ethic possible or desirable?", to which he said, "Of course it is impossible — of course it is desirable" (1999: 109). It may not be possible to create any kind of narrative by which a wide variety of publics can understand climate change, but it may be worth it to try. I believe that at the root of our various (interlinked) crises— the financial crisis, the ecological crisis, the crisis of climate politics (if you consider Copenhagen have been in crisis)— is a crisis of narrative. We lack a compelling storyline to draw together philosophies or ethics that could move us in some direction. Hence, the risk of not investigating this area is greater than the risk of sounding completely idealistic or hubristic. In the spirit of open experimentation, I venture to propose four themes of such a narrative.

1. Possibility, potential, and belief in human beings

Malthusian nightmares haunt the climate change discourse: images of conflict over water scarcity, hordes of environmental refugees, etc. Climate change is the story of our inability to create a healthy, just, and balanced world; geoengineering is constructed as the grim resolution to this story, and set against a geopolitical backdrop, where we imagine struggles over control of the Earth's thermostat.

To counter this imagined war of all against all— or the perspective of "strategic realism," as Gwynne Dyer, author of *Climate Wars,* puts it— climate change communicators could pull out the good traits in humans and focus attention upon them, like altruism and innovation. What if humans could cooperate on a new way of living upon the earth, with geoengineering as one component of this?

A post-Copenhagen common sense says that people are unwilling / unable to shift their societies away from fossil fuels. Strategic realism, or the grim geopolitization of climate, has become almost an unquestioned myth— and as Gramsci observes, common sense creates the folklore of the future (qtd. in Mosco, 2005: 29). If myth is "congealed common sense," as Mosco puts it, we have worked ourselves into some following a kind of myth where change is impossible:

a dangerous place to be, both politically and spiritually. What myths are not being lived, or told? A question from Nordhaus and Shellenberger worth considering: "How might history have turned out differently had we imagined the solution to global warming as *unleashing* rather than *restricting* human activity?" (2007: 127).

2. Art, ecological restoration, and the positive connotations of design

Think *technology*: what do you see? Machinery, power lines, circuit boards, beeping and blinking things? Perhaps it is time to perform an archeology on this word, and reclaim some of its earlier meaning. *Technology* comes from the word *techne,* meaning "art," art as in artifice, but also creation; the application of human imagination and skill to the world. Fundamentally, this has nothing to do with blinking devices, and everything to do with creativity and "tinkering." Much of the media coverage of geoengineering has disparaged "tinkering" with the world's climate, and while this is understandable, it also evidences a pessimism about a trait that may be embedded in human nature. Rather than disparage an urge to manipulate, could we rather seek to develop and refine it into a responsible art? This seems to be the thrust of Brand's *Whole Earth Discipline*, where he writes that "we're left with intention, with conscious design, with engineering. We finesse climate, or climate finesses us" (2009: 19). The names for this process are manifold (and often awkward)— Brand mentions managing the commons, tending the wild, mega-gardening, and intentional Gaia— but the concept, I believe, is rooted in art and design.

Perhaps there could be an ethical form of geoengineering, if it was part of a larger artistic vision. It is an important exercise to articulate what our best-case vision for geoengineering is. If we've accepted the premise that it is inevitable, then I posit that the optimal geoengineering situation is smaller-scale, locally managed carbon dioxide removal projects— regional and community carbon management— done in conjunction with decentralized, regional food systems and permaculture, organized so that individual gardeners and farmers could take part, and executed with a culturally-variable sense of beauty. Solar radiation management could be done to allow us time to actualize that vision, but it would only be ethical if done on the road to a more just and beautiful world.

3. Connection with nature

Let us return to this question of why "environmentalists" are against geoengineering. Anti-geoengineering sentiment, in many cases, comes from a story of being disconnected from nature, and a sense of pain at this lost connection. Geoengineering is seen as one more manipulation, one final injury inflicted upon a breaking and beaten planet. While this story, and this nature/culture divide, is still in place, geoengineering will have a difficult time capturing widespread public support and legitimacy in Euroamerican societies. A new narrative would necessarily have to address this divide, which has persisted at least since the Enlightenment, and tell a story of being connected to nature in a different way. It could posit geoengineering as part of a connection, rather than a disconnect. This is not implausible: geoengineers do listen to Mother Earth, intensely, and much of their research is developing ways to listen better; it is an intimate kind of connection, though not framed as such. Geoengineering would be a deep attachment.[7] More difficult than working with this sense of connection is dissolving the old binary, where human activity and culture is on one side and Nature / Environment is on the other. So you have "environmentalists" opposing human transformation, faithful to the binary.

"Environment started as a relation, a sense of connection, then turned into a thing," observes Proctor, who identifies a "double disconnect: first, moving from environment as surroundings to environment as a thing, and second, splitting environment into nature and culture sets of things along the way" (2009: 297-8). So the first task in healing this split, which has paralyzed environmental politics, is to un-thingify the environment. Or to, put it slightly more gracefully, to reconceptualize nature-society relations, and recognize that we are part of the environment, acting reflexively within it. "We are a species on Earth like any other, endowed, like any other, with specific capacities and powers that are put to use to modify environments in ways that are conducive to our own sustenance and reproduction," is how Harvey formulates it (1999: 122). This formulation is basic, unsexy, and I think it has a great measure of truth: human labor and human action are actually natural, and if they belong on the "nature" side of the divide, then the divide ceases to have meaning.

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[7] See Latour's 2008 essay on Nordhaus and Shellenberger's book for insights into the cognitive dissonance between the modern narrative of emancipation from nature, and the actuality of further attachments and entanglements.

4. Honestly recognizing the ways in which the world is flawed

Geoengineering is not an environmental issue. Like climate change, it is fundamentally a development issue. "Climate politics is precisely not about climate but about transforming the basic concepts and institutions of first, industrial, nation-state modernity," writes Beck (2010: 256). If we want to honestly and ethically deal with geoengineering— and deal with geoengineering in a way that will have any legitimacy— then we have to tread upon this ground, with the starting point being that the world right now is unequal and this needs to be changed. A good narrative to help us make sense of geoengineering might deal with reconceptualizing modernity— or modernizing modernity, as Beck puts it, going beyond "ecological modernization" to challenge its very premises. And this is deeply connected with the nature/society divide we've just been discussing.

Latour's insight in *We Have Never Been Modern* was that "we", the moderns, divide Nature and Society, while "they", the non-moderns (or pre-moderns) do not (1993: 99). They are supposedly at one with nature; then the Great Divide happens, and Nature and Society (or Culture) become increasingly purified essences, realms drifting apart. But if we get rid of this idea that we are somehow modern, then we open up space to reconceptualize these categories. And *this* opens up new political possibilities. As Latour writes,

> If we have never been modern... the torturous relations that we have maintained with the other nature-cultures would also be transformed. Relativism, domination, imperialism, false consciousness, syncretism— all the problems that anthropologists summarize under the base expression of 'Great Divide'—would be explained differently (1993: 11-12).

What is modern? Cleanliness, order and light.[8] And these things are possible without fossil fuels. Rather, fossil fuels represent pollution, messy extraction, inequality, corrupt regimes, etc. The new modernity is not auto-driven, oil-driven, or coal-fueled: it retains cleanliness, order, light, and health, plus whatever qualities you are inspired to add to it. It can be Islamic, Christian, Hindu; it finds joy in the other, it is cosmopolitan, and not defined by speed or accumulation, but flow. And, as Beck writes, "an alternative modernity will have to include a new vision of prosperity which will not be the economic growth held by those worshipping at the altar of the market. It will define wealth not in gross economic terms but as overall 'well-being' (2010: 262). The point where we actually make it past measuring wealth in terms of GDP may seem rather distant, but we have to aim for it (and this is the essence of this thesis: that it is vital to have a destination imaginary; that having a just and beautiful destination imaginary is the only thing that can give any kind of ethical support or legitimacy to a geoengineering project).

The political implications of not dissolving these categories— Nature and Society, Modernity and Environment— are grim. Beck explains that

> If you see an opposition between modernity and nature, then you see the planet too fragile to support the hopes and dreams for a better world. And then you will have to envision and enforce a kind of international caste system in which the poor of the developing world are consigned to (energy) poverty in perpetuity. The politics of limits will be 'anti' – anti-

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[8] Following Alain de Botton.

> immigration, anti-globalization, anti-modern, anti-cosmopolitan and anti-growth. It will combine Malthusian environmentalism with Hobbesian conservatism (2010: 263).

How do we get out of the politics of limits? The story comes first: otherwise we are stuck. Or, to quote Mosco, myths are pre-political: they can open the door "to a deepening of political understanding" (2005: 16). The story must enable the policies, because policies are trapped within the existing narratives about modernity and development.

What is the role of scientists in telling a new story? The Yale report on climate change recommends that the facts of climate change "must be actively communicated with the right words, in the right dosages, packaged with narrative storytelling that is based rigorously on reality, personalized with human faces, made vivid through visual imagery – and delivered by the right messengers" (Abbasi, 2006: 11). Are scientists the right messengers? While studies suggest celebrities like Oprah and Angelina Jolie to "spread the word" on climate change (Nielsen 2007), scientists have credibility when it comes to the facts. Obviously, scientists do not simply generate "facts" which the machinery of the press works to frame. Rather, the facts begin inside a frame, and are expressed through the frame in which they are generated: that is why a new narrative must start with scientists.

In the case of geoengineering, a small group of scientists has a large share of voice on the topic. This is a pretty interesting situation, where a small group of people has power to really frame a topic, at least in the mass media or traditional press. This is where many of the stories in the blogosphere are sourced from; the blogosphere is less wild that one might think. It is my hope that the scientists involved in geoengineering will choose to actively frame their work with creativity and compassion.

6. Conclusion: *Intersections of new media: potentialities and pitfalls*

Suppose that in ten years, geoengineering is a topic of public discussion. How could we make the leap from public discussion of geoengineering to public participation in geoengineering decision-making? Deliberation is at the heart of democracy, and is a prerequisite to the mechanisms mentioned above, so we will now examine the ways in which new media can support deliberation and discussion (and the ways in which it might hinder them).

Let me be clear that my approach to geoengineering and new media is not instrumental. Communication technologies are far more than tools. As Poster writes, "The Internet is more like a social space than a thing, so that its effects are more like those of Germany than those of hammers. As long as we look at is a hammer, we will fail to discern the way it is like Germany" (2001: 176). That is, we should approach new media to see how it intersects with geoengineering discussions— how new mediascapes shape the discussions, the political situation, and even the concept of geoengineering itself— but not think of new media is as a tool for conducting public dialogue.

New mediascapes seemingly hold a lot of promise to act as spaces where deliberative decision-making can happen. "The myths of cyberspace point to an intense longing for a promised community, a public democracy, or what Carey refers to in the American context as John Dewey's 'conjoint life of the polity,'" writes Mosco (2005: 15). According to Mosco, the myths of the digital age held that we would experience an epochal transformation, and "transcend time (the end of history), space (the end of geography), and power (the end of politics)" (2005: 3). Proclamations like this abounded in communication studies circa 2002, and though the tone has mellowed, the potential for increased democracy still exists. It exists simply because we have the infrastructure to talk to each other, even if we don't use it in deliberative-democratic ways. This infrastructure could take us in the direction of global democracy, and perhaps lead closer to Dryzek's vision of severing the close connection between democracy and the state: "democracy need no longer be confined to the processes of the state" (2002: 277). New mediascapes also offer new forms of collaborative intelligence-gathering, like Wikipedia, and the possibly to share information openly. This connection potential doesn't simply network us— it could allow for us to grow morally. It is through media that we see the Other; thus, as Silverstone writes, the media are an "increasingly significant site for the construction of a moral order" (2007: 7). If that other is increasingly like us— and if we can interact with that other— the story of the great modern divide between "us" and "them" starts to weaken a bit. But, as suggested in the introduction, these capacities are not always used, due to existing structures within the mediascape.

This brings us to the obstructions of new media in fostering public discussion. Firstly, to put it frankly, a capitalist media system does not exist for the purpose of serving the public good. There is some weight to the argument that have moved from a culture-debating public sphere to a culture consuming-one, as Wilhelm states (2000: 145), and many critics have lamented this. With regards to geoengineering, this can play out in issues of shallow, sensationalist coverage, and (more significantly) lack of coverage. For example, in the public consultation to the UK Climate Change Act 2008, most people did not hear about the consultation in the press— it faced low coverage, and none of Scheer and Höppner's interviewees heard about it in the media (2010: 267).

Another obvious disadvantage of relying on new media for public discussion is the "digital divide", where access to information technology is unavailable for many. Somewhat less obvious is the phenomenon of narrowcasting, where people seek out information that they are interested in and that suits their worldviews (or where people are offered content that suits their previous interests, as happens in personalized Google searches). Sunstein is concerned that the internet is "producing a decrease in unanticipated, unchosen interactions with others" (2001: 23). Hence, "a decline in common experiences and a system of individualized filtering might compromise the ideal of deliberative democracy" (2001: 26). Sunstein also points to social science research about group polarization: that groups of like-minded people who discuss an issue end up thinking what they thought before, but in more extreme formulations (2001: 65). New media allows us to congregate in niche communities where we are exposed to issues that are of concern to us— but we might not hear about issues that we don't already care about.

Still another potential concern with new media is the diffusion of responsibility problem. As Silverstone observes, the screen "grants sensation without demanding responsibility" (2007: 119); we can learn about situations without having to be responsible for them. A seminal report from a conference put on by Yale on Americans and climate change includes a section on "Dialogue as an Antidote to Diffusion": "Put simply, it becomes harder to tell yourself that someone else will lead on climate change if you're in a room with them and they're looking back at you saying the same thing about you" (Abbasi, 2006: 71). The report's solution is that "innovative dialogues can help counter the 'diffusion of responsibility' phenomenon", and they recommend "a more open-ended type of activity in the form of organic, unscripted, and authentic dialogues between people who don't normally connect" (ibid.). It is arguable that face-to-face discussion on geoengineering is preferable to mediated discussion, as it may demand a deeper connection and commitment.

Of course, there are elements of how new media works which can't easily be placed into neat categories of positives or negatives. One is performance: as Hajer writes, in a mediatized age, "we are now looking towards a politics that starts with the fact that publics are now active judges of performances" (2009: 181). There are specific knowledges of how to perform (and, I might add, how to include narrative, or at least drama) that can be valuable, even if the actors in the situation never wanted to become actors in the dramaturgical sense.

A second element of how new media works is speed, and the inclusion of fringe elements into the wider discourse. Stories move rapidly through the mediapolis; it is difficult to understand exactly how this operates. We recently saw a preacher with a following of 50 spark an international crisis because of this (the man in Florida who began with some YouTube videos about burning the Koran this September 11, whose story moved from the blogosphere into the mass media via the *Guardian*, until Obama himself had to intervene). It is not difficult to imagine a similar sequence of events with the topic of geoengineering, where the voices of fringe elements become represented in the wider world as if they were less-than-fringe elements. (However, when these stories go viral in this manner, the system seems to clear the virus equally as quick.)

Thirdly, lack of face-to-face interaction is an interesting variable— Rowe and Gammack ask how the reduction of social cues impacts electronic engagement mechanisms and exercises (2004: 46). They suggest that electronic engagement brings status equalisation: that lay members of the public would be more willing to engage frankly with people who have higher status, like experts and policy-makers (ibid.). They also point out that computer-mediated groups more frequently exhibit uninhibited behavior (Rowe and Gammack, 2004: 49, after Siegel et al, 1986). This could help or hinder geoengineering discussions.

A final musing on this intersection of new media, discussion, and decision-making: I wonder if computer-mediated communication is an appropriate way to deal with technologically mediating our climate. Will interacting through programmable media make us more comfortable with the idea of programming our climate; is there some analogy or resonance there? Furthermore, as climate impacts bodies— it is an intimately physical matter— should we be talking about it in body-to-body communication, in the physical realm?

I would like to conclude with a key notion from Fiorino (1990): that *participation is not primarily reactive*. When discussing how to decide about controlling the climate, the best mechanism for participation will not simply allow citizens to choose between geoengineering strategies like they are in a supermarket, selecting the goods that suit the situation best. Democracy is not about choosing, it is about speaking (see Fishkin, 2009). Rather, a good mechanism will encourage citizens to create their own visions of the kind of world and climate they want to live in: to author their own circumstances.

This is so far from where we are now that it sounds almost absurd; yet it is a worthwhile goal. At the moment, authority for the climate rests with natural scientists, who in many cases don't even want authority. This works for the topic in its nascency, as nobody besides scientists seems to know much about geoengineering. At some point, however, more actors will be making assertions and wanting to be heard: and then we will have to truly begin the difficult task of figuring out how to reconcile the idea of large-scale geoengineering with notions of democratic consent.

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