

A Curious Asymmetry: Social Science Expertise and Geoengineering

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Climate Geoengineering Governance

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Abstract

Political action on climate change has been slow enough to cause despair in a section of the scientific community, resulting in increasing advocacy of research and development of geoengineering technologies. Many, including some social scientists have been critical of the idea of geoengineering. One concern, raised in relation to geoengineering using stratospheric sulphate aerosols (SSA) is that SSA will need to be governed globally and thus raise problems of legitimacy. However, as this article points out, the legitimacy of global institutions which might address climate change was rarely mentioned by social scientists in the case of mainstream climate discourse. This asymmetry is an interesting fact in itself and additionally raises a question about the role and methodology of the social scientists who are beginning to examine public perception of geoengineering technologies. This article traces the development of geoengineering discourses and highlights the technocratic overtones of the previous climate change and environmental discourses that facilitated the advent of geoengineering research as a serious policy option. It goes on to point out the asymmetry in attitudes towards geoengineering and more conventional responses to climate change and suggests that the critical attitudes towards geoengineering are based on particular views of democracy, which themselves are contestable, and technological essentialism. Finally, using Cultural Theory, it offers an explanation of why this asymmetry has arisen.

Keywords: the Anthropocene, Cultural Theory, democracy, expertise, geoengineering, technocracy.

Introduction.

There are few instances where the expertise of natural scientists and engineers has been scrutinized and questioned as much as the scientific literature and discourse on climate change. As noted before (Hulme 2009), the challenges to the scientific findings are most often politically grounded. Experts in the natural and engineering sciences have, with a few exceptions, responded by trying to think of ways to make the general public understand the often-complicated facts about climate change. Social science experts, particularly those with a background in public engagement and deliberation, have frequently been recruited to this task. Despite the discrediting of the “deficit model” of public understanding in other examples of science communication (Irwin and Wynne 1996; Miller 2001), many social scientists seemed content to accept the agenda of the natural and engineering scientists and play the role of “facilitating” public understanding of climate change (e.g. Moser and Dilling 2004; 2007).

Despite these efforts, political action on climate change has been slow enough to cause despair in a section of the scientific community, leading them to advocate research and development of technologies to achieve, in the words of Shepherd et al. (2009:1) “the deliberate manipulation of planetary systems to counteract anthropogenic climate change” (e.g. Crutzen 2006; Blackstock et al. 2009; Caldeira and Keith 2010; Keith et al. 2010). This heterogeneous range of potential technologies is often given a single term: *geoengineering* and is conventionally divided into carbon dioxide removal (CDR) methods and solar radiation management (SRM) methods (Shepherd et al. 2009). Stratospheric Sulphate Aerosols (SSA) is an example of an SRM method and the most often-discussed example of a proposed geoengineering technology.

We emphasise that all geoengineering technologies, including SSA, are proposals. No complete geoengineering technology yet exists. There are

some pieces of equipment that could be adapted for deployment as part of a geoengineering technology, but we are still far from any kind of sociotechnical system capable of achieving geoengineering goals in a controlled fashion. Geoengineering technologies are currently what STS scholars refer to as “technological imaginaries” (Jasanoff and Kim 2009), in which the specific conditions under which they could be developed and deployed remain uncertain and implicit. The factors affecting the social acceptability of geoengineering technologies, such as the resource requirements, engineering techniques, financing and, most importantly for our purposes, governance arrangements that would be needed for any geoengineering system to operate are thus as yet relatively unexplored and therefore unelaborated.

Notwithstanding the indeterminate characteristics of whatever geoengineering technologies might emerge, critics have raised objections to some of them, especially SSA, on the grounds that they raise problems of legitimacy (e.g. ETC Group 2009). While social scientists addressing geoengineering all recognise that such technologies raise real issues about how they might be effectively and democratically governed, some seem to have already decided that such technologies are inherently, i.e. essentially undemocratic (e.g. Macnaghten and Szerszynski 2013). This position is of interest, not just because it seems to others too early to make any kind of judgement about technologies as yet unformed, but because it flies in the face of the well-developed STS critique of essentialism. It is also interesting to note that the social science critics of geoengineering do not seem to question the legitimacy of government policies and even of international institutions designed to achieve drastic emissions reductions. Indeed, social scientists seem to have become more critical of geoengineering technological imaginaries and at a much earlier stage than they have been of proposals for drastic emissions cuts in the “mainstream” climate change discourse. We highlight this because it raises questions about the role of social science expertise just as social scientists are beginning to examine

public perception of geoengineering technologies. Our concern is that social science expertise may be shaping or configuring the public responses to geoengineering technologies, rather than reflecting them. We seek to highlight this issue for the social sciences and to give some reasons as to why social scientists and others seem more ready to seize on potential governance implications of geoengineering technologies than on those raised by the emissions reduction (mitigation) agenda.

We begin, in section 1, with the recent emergence of geoengineering discourses, in which social scientists have played a role from the early stages. Section 1 also identifies some features of complementary discourses of tipping points and the Anthropocene, within which some scientists and activists locate geoengineering, and highlights their technocratic overtones. In section 2, we discuss an example of the critical stance being taken by social scientists and, in section 3, point out the asymmetry in attitudes towards geoengineering and more conventional responses to climate change. Section 4 offers an explanation of this asymmetry. Section 5 concludes.

1. The Emergence of Geoengineering Discourses

Just as the political issue of anthropogenic climate change emerged from expert scientific discourse, the same is true of the latest development, the proposal that geoengineering should be considered among the various policy responses to climate change. In both cases, the agendas have been set by earth systems scientists. But, whereas social scientists seemed fairly content to follow the imperatives set by earth systems scientists when it came to implementing mitigation, there has been immediate reticence among some social scientists in accepting the arguments from natural scientists in the case of geoengineering, particularly in the case of SSA (e.g. Hulme 2012).

Concern about climate change, and societal responses to it, emerged as an expert discourse initially among natural scientists, who still predominate. The same is true of the idea of geoengineering. The idea has been around for many years. Cesare Marchetti (1977) first used the term specifically in relation to climate change, but proposals that would now be regarded as geoengineering have been occasionally mooted since the 1960s.

However, geoengineering remained very much on the disreputable fringes of the climate discourse, with the majority of climate scientists viewing it as a taboo subject (Lawrence 2006; for an exception see Keith 2002). This initial reluctance remains reflected in the often-expressed concerns about what has been (wrongly) termed “moral hazard” (Shepherd et al 2009; Keith et al. 2010) - that research into geoengineering techniques will undermine the case to reduce greenhouse gas GHG emissions among policy-makers or the broader public. Paul Crutzen - winner of the Nobel Prize for his work on stratospheric ozone depletion - broke the scientific community’s self-imposed taboo in a paper in *Climatic Change* arguing for research into stratospheric sulphate aerosols as a potential geoengineering technology (Crutzen 2006). Since then, several reports from scientific and science policy bodies have appeared, or been commissioned by governments, along with a flurry of articles arguing for increased efforts and funding in research of geoengineering techniques.

The idea that geoengineering could be required to deal with a future “climate emergency” was a strong theme in many early articles advocating research efforts into geoengineering. Following Crutzen (2006), many climate scientists argued that there was a pressing need for research into SSA because it promises to be a fast-acting technology that could be deployed to avert abrupt climate events (see for example Blackstock et al. 2009; Victor et al. 2009; Caldeira and Keith 2010; Blackstock and Long 2011; Long et al. 2011; Goldblatt and Watson 2012; Victor et al. 2013). While there are other arguments for SSA research, the climate emergency

argument was a key argumentative strategy. As has been argued elsewhere (Heyward and Rayner 2013), this particular argument arguably broke the scientific community's self-imposed taboo on the advocacy of geoengineering research.

The climate emergency justification was itself facilitated by a growing emphasis on abrupt climate events and especially "tipping point rhetoric" in mainstream climate discourse. The term "tipping point" was coined by Malcolm Gladwell and developed in a popular book about social change (Gladwell 2000) but was later imported into the climate discourse by Hans Joachim Schellnhuber and introduced into peer-reviewed scientific papers by James Hansen (see Russill and Nyssa 2009). What began as a strategy used by scientists to communicate climate change to non-experts became the subject of research papers (e.g. Lenton et al. 2008; Kriegler et al. 2009; Lenton 2011) and invoked in various research agendas.

Tipping point rhetoric emphasises irreversible, abrupt and catastrophic climatic changes. Those who employ it typically argue for immediate measures to avoid crossing an irreversible threshold (e.g. Rockström et al 2009). The introduction of tipping point rhetoric into mainstream climate discourse thus primed audiences for the idea of a climate emergency. Whereas the original users of tipping point rhetoric urged immediate curbs on GHG emissions, climate emergency rhetoric advocated a different course of action, namely research into SSA.

Another theme which has been invoked in support of geoengineering research is that of the Anthropocene, a term originally coined by Eugene Stoermer and popularised by Paul Crutzen (2002), who suggested that the influence of humankind on fundamental earth systems had become so significant as to usher in a new geological era. He wrote:

For the past three centuries, the effects of humans on the global environment have escalated. Because of these anthropogenic

emissions of carbon dioxide, global climate may depart significantly from natural behaviour for many millennia to come. It seems appropriate to assign the term 'Anthropocene' to the present, in many ways human-dominated, geological epoch, supplementing the Holocene — the warm period of the past 10–12 millennia. The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt's design of the steam engine in 1784 (Crutzen 2002: 23).

Others have taken up the concept, which is now the subject of many scientific research articles, conferences, research agendas and most recently, a scientific journal.¹ As the era of the Anthropocene is increasingly invoked, it is not surprising that different participants employ it in different ways. Depending on the predilections of the speakers, the discourse of the Anthropocene might be intertwined with warnings about tipping points (e.g. Biermann et al. 2012) and the need not to exceed planetary boundaries (Rockström et al. 2009.) Sometimes it is connected directly with the need for geoengineering research (Crutzen 2002: 23; Steffen et al. 2007: 619). Regardless of the final prescriptions for action, there are some common features in discourses of the Anthropocene. The acceptance of these features in general discourse means that the idea of geoengineering the climate no longer seems so alien or unthinkable.

The concept of the Anthropocene asserts that humanity and the planet which it inhabits have entered a new era, but there are at least two different ways in which this era is characterised. One focuses on the overwhelming biophysical effects of human activity, which Crutzen dates as beginning in the eighteenth century. Others argue that it has a much longer history, for example, beginning with the advent of agriculture (Ruddiman 2003). The argument over the date of origin is politically charged, with commentators

who are most worried about the prospect of passing a global tipping point favouring the later date. In their view, pushing back the onset of the Anthropocene by several millennia dilutes the concept's immediate mobilising power.

Another way of characterising the Anthropocene focuses on human consciousness of its role in shaping the planet rather than the advent of that role. In the words of New York Times journalist Andrew Revkin: "Two billion years ago, cyanobacteria oxygenated the atmosphere and powerfully disrupted life on earth.... But they didn't know it. We're the first species that's become a planet-scale influence and is aware of that reality. That's what distinguishes us." (quoted in Stromberg 2013). Steffen et al. (2007) divided the anthropocene into three substages: the "Industrial Era (circa 1800-1945), the "Great Acceleration" (circa 1945-2015) and finally, a potential future, "Stewards of the Earth?", from 2015 onwards. The main feature of the last is that it is characterised by "[t]he recognition that human activities are indeed affecting the structure and function of the Earth System as a whole (as opposed to local and regional scale environmental issues) ... filtering through to decision-making at many levels" (Steffen et al. 2007: 618). The new era is effectively one of human consciousness: the recognition that humanity has great effects on the planetary environment. Regardless of when the power of humans became so great (agriculture or the Industrial Revolution) it is now that humanity is starting to realise this fact.

A further feature of the Anthropocene discourse follows from this recognition. Having realised the power of humanity over the planetary environment, we must change our ways of thinking and our ways of acting. Steffen et al. (2007) express the hope that humankind will, over the next few years, wake up to the impacts that it is having on global systems and do whatever it takes, by adopting new technologies, changing values and behaviour or, most likely, a combination of both to ensure that life can

continue. The idea of Anthropocene is thus invoked to do political work.

Moreover, as currently expressed, the political agenda of the Anthropocene has strong technocratic overtones. The thought is that new scientific understandings must affect political decisions and change human behaviour. The discourse of the Anthropocene might be regarded as the latest instance of a longstanding human propensity to appeal to nature to justify moral and political preferences. For example, Rayner and Heyward describe how at the 2012 "Planet Under Pressure" conference, "reality" and "nature" were frequently invoked as the impetus for political action. Johan Rockström, the lead author of the influential "planetary boundaries" hypothesis, drove home the point claiming that "We are the first generation to know we are truly putting the future of civilization at risk" and the Dutch political scientist Frank Biermann spelled out the imperative that "The Anthropocene requires new thinking" and "The Anthropocene requires new lifestyles" (quoted in Rayner and Heyward 2013: 141), whereas the *State of the Planet Declaration*, produced by the Planet Under Pressure conference stated that "consensus is growing that we have driven the planet into a new epoch, the Anthropocene" and called for a "new contract between science and society in recognition that science must inform policy to make more wise and timely decisions ..." (Brito and Stafford-Smith 2012: 6). The Anthropocene is thus taken to mandate the greater involvement of scientific experts in policy-making. Crutzen himself wrote "A daunting task lies ahead for *scientists and engineers* to guide society towards environmentally sustainable *management* during the age of the Anthropocene (Crutzen 2002, our emphasis). Scientific expertise is needed to tell policy-makers when planetary boundaries are in danger of being exceeded, tipping points approached and to guide policy-making to ensure that disaster is averted and that critical planetary systems are maintained.

Like tipping point rhetoric, the Anthropocene discourse offers the possibility of two quite different technocratic futures relying on slightly different forms

of expertise. One emphasises fundamental behavioural and institutional transformation to ensure that humanity develops within “planetary boundaries” set by earth systems scientists. Within this framework, the job of social scientists is to persuade politicians and publics of the need to act and to design policy instruments to achieve the desired goals. The other, less sanguine about the prospects of changing embedded socio-technical practices and overcoming vested interests, would deploy engineering expertise to cut the Gordian knot of inexorably rising greenhouse gas emissions through geoengineering. Perhaps contrary to the views of social scientists who see SSA as inherently undemocratic, social scientists and ethicists have been engaged much earlier in the process of thinking about the acceptability and governance implications of geoengineering (e.g. Shepherd et al. 2009) than they were in developing the more conventional approach to climate change through emissions mitigation.

In any event, both potential futures highlight the idea that new ways of thinking are needed: in the case of geoengineering, priming audiences to think about whether it is now permissible to intervene in planetary systems at a large scale. After all, the success of any geoengineering technology is predicated on the idea that nature can (and now should) be carefully managed. In both futures, management is dominated by scientific experts. The prospect of control over the Earth’s biological, chemical and physical systems marks the completion of the transition to the third stage of the Anthropocene, “wise stewardship” of nature. The whole planet becomes a garden, to be managed by those who have the requisite skills and experience.

In the case of geoengineering, the technocratic ideals embodied in the Anthropocene discourse and also in tipping point rhetoric, sit uneasily alongside calls emanating from researchers insisting on the necessity of broad public consultation and engagement in the governance of geoengineering technology (Shepherd et al 2009, SRMGI 2011, Carr et al.

2013). The motivations behind such calls are many and mixed ranging from a largely pragmatic instrumental concern about securing public acceptance or a social licence to operate, through the idea that public input will result in a substantively more robust technology, to the conviction that it would simply be wrong to proceed without prior informed consent from the public.

Social scientists have noted such tensions. For example, Melissa Leach recently couched the issue in the following terms:

Is there a contradiction between the world of the Anthropocene, and democracy? The Anthropocene, with its associated concepts of planetary boundaries and 'hard' environmental threats and limits, encourage[s] a focus on clear single goals and solutions ... It is co-constructed with ideas of scientific authority and incontrovertible evidence." (Leach 2013).

Leach does not contest the idea that there are "natural limits" or non-negotiable targets for sustainable development. Rather, she points out that the role given to scientific experts in identifying them could mean that the same experts have a more than appropriate role in determining the pathways and courses of action that should properly be left to contestation of interests and values characteristic of democratic politics.

Given the framings and tone of early discussions of geoengineering and SSA in particular, it is perhaps not surprising that social scientists have been swift to seize upon the possible implications for democracy. However, there may be some pitfalls associated with doing so. The next section outlines these, with reference to a recently published article which details some research into public perceptions of SSA.

2. Geoengineering and Democracy

In the conclusions of a paper reporting focus group research into public

perceptions of SSA, Macnaghten and Szersynski (2013: 472) claim that the technology has “an anti-democratic constitution” that is incompatible with liberal democracy. In support of this conclusion they identify four themes arising from their focus group discussions:

1. Conditional acceptance of SSA.
2. Scepticism of the ability of climate science as a reliable guide to policy or as able to predict side effects, and whether the technologies could be tested at a sub-deployment scale, both leading to the concern that human beings will be the guinea pigs in a climate experiment.
3. Concern that technology would become politicised and used in ways that are radically at odds with intended purpose of countering climate change.
4. Lack of confidence in capacity of existing political systems to accommodate SSA.

They conclude that their research shows a “more consistently sceptical position about the prospect of geoengineering than has been reported in earlier research” and questions “whether solar radiation management can be accommodated within democratic institutions, given its centralizing and autocratic ‘social constitution’” (Macnaghten and Szersynski 2013: 472). Points 3 and 4 clearly raise issues of legitimacy and thus relate to their worry that there is significant potential for SSA to “negate democracy” (2013: 472). However it is one thing to say that there are concerns that technology might become politicised and that there is a lack of confidence that existing systems can manage SSA. It is quite another to claim that SSA has a centralizing and autocratic social constitution – and that therefore that it is essentially undemocratic.

Moreover, as Macnaghten and Szersynski themselves acknowledge, the concerns about democratic legitimacy did not appear spontaneously. Rather, the researchers began by introducing the subject of SSA under the conventional frame of the perceived need to buy more time for greenhouse

gas mitigation policies to become effective, but subsequently introduced additional possible framings. These were perspectives from environmental and civil society actors and the geopolitical history of weather and climate modification, for which James Fleming's (2010) book, highly critical of geoengineering, was the only reference given.² Thus, the concerns about democratic governance were raised by the focus group participants only after the introduction of more critical materials highlighting "the possible use of solar radiation management techniques or social, political, and military purposes unrelated to climate change policy" (Macnaghten and Szerszynski 2013: 468).

This methodological move could suggest that, rather than emerging spontaneously from the focus group, the group's responses were configured by the authors' own concerns about SSA and its incompatibility with their particular model of democracy. While Macnaghten and Szerszynski concede that "some may argue that [our framing] may have unduly shaped public responses" (2013: 472), they argue that they were attempting to "open up" the debate (Stirling 2005) by the use of deliberative methods. However, there remains a real question of whether this is a case of what Roger Pielke Jr (2007) describes as "stealth advocacy." There are grounds for concern that researchers, rather than providing objective analysis and preserving the STS principle of symmetry, may configure the public in accordance with their own critical image of geoengineering as "anti-democratic".

By their own account, Macnaghten and Szerszynski's conviction that SSA is inherently undemocratic arises from the claim that its effects are manifest on a planetary scale and that it must be controlled centrally, presumably by a global body. They write:

Democracy, in its various forms, depends on the articulation, negotiation and accommodation of plural views and interests. It relies on an evolving and partially flexible relationship between citizens and

governance institutions. Solar radiation management [sic] *by contrast exists as a planetary technology*. While plausibly able to accommodate diverse views into the formulation of its use, once deployed, *there remains little opportunity for opt-out or for the accommodation of diverse perspectives*. By its social constitution it appears inimical to the accommodation of difference. *Following deployment it could only be controlled centrally and on a planetary scale* (Macnaghten and Szerszynski 2013: 472, our emphasis).

Thus, Macnaghten and Szerszynski's view of democracy requires that individuals not only have a right to express dissent, but have either the ability to *determine*, rather than influence, whether SSA is used, or the ability to "opt out" - to be able to live in an environment free of the use and effects of SSA. This draws on a particular model of democracy that has been common to much STS scholarship since the 1970s and which is rooted in the ideal of a tight-knit community of highly engaged citizens, where intense deliberation is possible (Barber 1984; Lengwiler 2008; Durant 2011). Such a model of democracy favours small, decentralised units of consensual decision-making and is generally suspicious of political mechanisms for large political units and their mechanisms which distance executive power from citizens. From this point of view, aggregative or representative forms of democracy (Lovbrand et al. 2011) are seen as inferior, or even stalking horses for authoritarianism.

The consensual participatory conception of democracy can appear rather demanding. If being able to opt out of decisions were a standard feature of any political institution, the result would be more akin to anarchy rather than democracy. For example, ordinary citizens do not have a general right to opt out of their governments' laws, even if they disagree with them. The simple fact that we cannot refuse to pay taxes, decide to drive on the wrong side of the road, or carry a machete onto the London Underground does not mean by itself that the UK is an undemocratic country (even if there are

other reasons for asserting that it is). Thus, on another reasonable view of democracy, living in a political community means some restrictions on behaviour – including restrictions on the right to opt out of certain decisions. From this point of view, what makes a political community democratic is whether people have an adequate say in the decisions which affect their lives. It is not to guarantee that the decisions will go their way, or that they will be subject only to decisions that they have actually consented to.

This is not in any sense a full critique. A full description of this position would have to flesh out what counts as “having an adequate say” and what kinds of restrictions on behaviour are justifiable. This brief outline is simply intended to show that the jump in reasoning between “no opt-out” and “undemocratic” is open to challenge. Representation of citizens, rather than their continual active involvement as well as non-consensual forms of consent, such as forms of hypothetical consent and also revealed consent (“voting with the pocketbook”) are present in actual democracies (Calabrese and Bobbitt 1978). It is too simplistic to assume that a failure to secure universal explicit consent for a decision makes that decision, or even that society “undemocratic”.

Nor is it enough merely to assume or assert that global or centralised political structures must be undemocratic. It is possible to envisage a system where any institution governing SSA would be part of a multi-lateral global order, subject to checks and balances. Much would have to be done to establish appropriate checks and balances and maybe it would turn out to be impracticable. The historical record of global institutions is mixed. We do not we claim that multilateral governance of SSA would necessarily be democratic, but equally we would challenge the notion that it must necessarily be anti-democratic as Macnaghten and Szersyncski claim. While recognising the potentially undemocratic implications of technologies powerful enough to affect the global climate, it is premature to impose inherent characteristics on an as-yet unformed sociotechnical imaginary.

To conclude this section, it might be said that Macnaghten and Szerszynski's critique rests on a particular, one might say "essentialist" model of democracy, insisting that the contextual conditions for SSA technology can only be such that SSA is incompatible with that model. However, just as an appeal to scientific facts does not determine the political response, a technology does not automatically require a certain political set-up in order to operate. There is a long tradition of critique of "technological essentialism" in the social sciences but this seems to have been forgotten in the case of SSA.

3. Geoengineering and Social Engineering: A Curious Asymmetry

We noted earlier an apparent asymmetry in the social science attention to the social, ethical and political questions arising from the possibility of geoengineering compared to mitigation and other conventional climate change responses. Many of the most pressing concerns about the governance of geoengineering also seem to apply to climate change generally. Take the example of democracy. If global institutions and planetary management systems are, per se, threats to democracy, then that must be true for proposals of "Earth Systems Governance" and management of "planetary boundaries" as proposed by Rockström et al. (2009). While Leach (2013) raised concerns about democratic credentials of these political proposals, she carefully refrained from suggesting that a planetary management system would inevitably erode democracy. One is tempted to ask whether the social scientists objecting to SSA on the grounds that it is anti-democratic have similar reservations about global treaties and institutions aimed at promoting mitigation. Perhaps they do, but these kinds of objections are raised less often in discussions of governance in the case of conventional climate discourse focusing on mitigation and adaptation. Indeed, in this context it is usually the lack of progress in developing an equitable and universal regime that is seen as

unjust, and threatening to the most vulnerable. For example, Bierman et al. (2012) recommended several institutional reforms in the name of effective Earth System Governance including: the “upgrading” of the UN Environmental Programme so that it becomes a specialist UN agency with a sizeable role in agenda-setting, norm development; compliance management, scientific assessment and capacity building” (the environmental equivalent to the World Health Organisation); measures to further integrate sustainable development policies at all levels; and the closing gaps in global regulation, especially of emerging technologies. These proposals for global institutions and stringent policies designed to achieve radical changes in human behaviour to "save the planet" seem to escape symmetrical criticism as “undemocratic” from those who raise concerns about SSA.

It seems that, in common with most members of the natural sciences community (including some of those who actively pursue research and development of geoengineering technologies) many environmental activists and campaigners, social scientists are deeply troubled by the prospect of using certain geoengineering technologies. This raises a potential problem for those engaged in social science research on geoengineering. Should the social science expertise be deployed to shape what the public thinks, or focus on identifying pre-existing public opinion. Does focusing on the anti-democratic potential of SSA, but not other global governance, give a misleading impression to the public that problems of global governance and legitimacy are intrinsic to SSA, or more broadly to geoengineering³, but are not equally worrisome when it comes to the extensive social engineering called for in relation to emissions mitigation measures.

4. Accounting for the Asymmetry?

We have pointed to an apparent asymmetry in the application of social science expertise. Whereas in the case of conventional responses to climate

change, social scientists accept the proposal for global institutions, technological innovation and changes in thinking, lifestyle and values, similar proposals in relation to SSA are coming in for criticism. What might account for this? We offer an explanation using the anthropological paradigm of Cultural Theory (Douglas 1970, Thompson et al. 2000).

Perhaps it is simply the case that the problematic implications for democracy are made far more visible much earlier in the case of SSA. Early climate emergency justifications for SSA exhibited a particularly worrisome coercive quality. Research, and research *now*, into SSA was presented as the *only* possible course of action that could avert a possible climate emergency (e.g. Calderia and Keith 2010).⁴ Moreover, "emergency" arguments are discomfiting: a declaration of a "state of emergency" has been used many times by political leaders both in autocratic and largely democratic countries to justify oppressive political action and close down dissent and debate. This feature of emergency rhetoric was noted, seemingly approvingly, in an early report on geoengineering: "in a crisis, ideological objections to solar radiation management may be swept aside" (Lane et al. 2007:12). By using such bold statements and "state of [the planet] emergency arguments", we might say that the early proponents of SSA research effectively invited scrutiny of the distribution of political power and the possibility of authoritarianism.

However, Cultural Theory offers an alternative or possibly complementary perspective. It points out that people's expectations, views and preferences are linked to the different social contexts in which they find themselves throughout their lives. What is visible, obvious or even blatant in one social context is ignored, overlooked or invisible in another. It is not enough merely to assert that early proponents of SSA made obvious (perhaps unwittingly) the potential governance problems whereas those advocating mitigation and adaptation did not. The question to be answered is why in the former case, the anti-democratic line of critique was noticed and raised, and

in the latter case, despite many apparent similarities, it was not.

Cultural Theory posits four main social contexts and four associated “voices” or perspectives that accompany them. The voices offer different stories about human nature, individual-group relations, the natural world, risk, responsibility and distributive justice. The voices are termed *individualist*, *hierarchical*, *egalitarian* and *fatalist*. Of these, the first three voices are politically active. Politics, according to Cultural Theory, can be understood in terms of fluctuations in the relative power of the three politically active voices. Often alliances are made, but they are rarely permanent. We suggest that the increased criticism of SSA is a result of a long-standing alliance in environmental politics, one between hierarchical and egalitarian approaches, is beginning to show some cracks because of the advent of geoengineering.

The conception of democracy that we identified as being behind Macnaghten and Szersynski’s criticism of SSA is a view of democratic legitimacy as being instantiated in a small autonomous community, characterised by active participation of its citizens, who are regarded as equal to all others, and governed by the active consent to decisions by those citizens. From this perspective, as we saw, global institutions and decisions from which citizens cannot opt-out, are not regarded as democratic. This view of individual-society relations and democratic legitimacy is that of the egalitarian perspective in Cultural Theory. The egalitarian perspective also holds that nature is very delicately balanced and the slightest perturbations can lead to catastrophe. Hence the egalitarian prescription in environmental politics is to respect nature’s fragility and make only minimal demands - the quintessential Green “tread lightly” approach.

The hierarchical perspective sees the community as being tightly bounded but unlike the egalitarian, active participation and explicit consent from all of its citizens is not necessary to legitimate every political decision.

Day-to-day decisions are best left to expert management. What makes them legitimate is whether the community's citizens, if all fully informed and reasonable, would consent to the decisions, or at least the procedures for making them. The hierarchical view of nature is "perverse – tolerant". Nature does have limits and transgressing them can lead to catastrophe, similar to the egalitarian conception. However, from the hierarchical viewpoint, natural systems are not always on the verge of collapse and natural systems can be exploited to some degree and managed with suitable skill. The hierarchical view thus privileges expertise in all fields and out of all the voices, has the greatest tendency towards technocracy and authoritarianism.

The individualist viewpoint, in contrast to the hierarchical and egalitarian, does not see social relations as being a tightly bound community, but more akin to a network of individuals, connected by market relations.

Accordingly, decisions are the aggregate of individuals' own private decisions. According to the individualist, nature is robust and able to withstand any human interference or exploitation. Therefore, in global environmental politics, it is the individualist perspective that is most associated with climate scepticism. There is no need for mitigation of GHG emissions. Moreover, curbing greenhouse gas emissions has redistributive consequences that the individualist viewpoint regards as going against the free market and hence, unfair.

The individualist perspective is the critic of initiatives to curb GHG emissions because of climatic change (Thompson and Rayner 1998). Hence, the political action we have seen on global climate change can be largely attributed to there being a coalition between the other two active voices. The egalitarian voice succeeded in appealing to hierarchical values to adopt its agenda of mitigating emissions because the continued accumulation of GHGs in the atmosphere will lead to a catastrophe, and one that will most adversely affect the very poorest. Egalitarians can hope to use hierarchical

means to serve their ends, but in order to do this, “the egalitarian must moderate their suspicion of authority” (Thompson et al. 2000:89). Hence, the political price for the egalitarian viewpoint in having their calls for mitigation heeded has been to overlook the “uncomfortable knowledge” (Rayner 2012) of the hierarchical forms of democracy and legitimacy – and the tendencies towards technocracy and possible authoritarianism.

The egalitarian call for mitigation of greenhouse gases was, for many years regarded as the only acceptable course of action in the face of anthropogenic climate change. Even adaptation was once regarded as taboo (Pielke et al. 2007) and the “fragile planet” image of the egalitarian worldview, with support from hierarchical views, became hegemonic in climate change discourse (Rayner 1995). From the egalitarian perspective, this was worth staying silent when new, further integrated global institutions were mooted and greater roles for technical scientific experts were advocated. If the hierarchical voice and the egalitarian voice shared the same goal – global mitigation, then criticism of the other’s means would be counter-productive in achieving those goals.

However, unlike the egalitarian, the hierarchical viewpoint is not intrinsically committed to the “tread lightly” approach to nature. To date hierarchy has accepted mitigation and, more recently, adaptation as the only available forms of responsible climate change management. The emergence of the idea of geoengineering, especially SSA, challenges this belief. Geoengineering, we might say, is the ultimate in environmental management, in terms of its scale and complexity. As a form of environmental management, it is congruent with the hierarchical perspective. As a proposal for more, rather than less intervention in natural systems, it is in stark opposition to the egalitarian perspective. Hence, if the hierarchical and egalitarian perspectives start to disagree about the appropriate responses to climate change, then there is less incentive for the egalitarian voice to refrain from criticising the hierarchical institutional

means. Hence we hear the egalitarian critique of global institutions and technocracy more strongly when SSA is being discussed, than when the egalitarian's preferred solution is made the objective. Here, then is one possible account of this seemingly puzzling asymmetry.

5. Conclusion

The discourses of both climate change and geoengineering responses to climate change emerged from the expert scientific community. In the first case, scientific expertise became entrenched as the policy driver, leading in turn to a significant backlash on the part of those who saw the prescribed course of action as inconsistent with their values. However, for the most part, social scientists seemed content with the subaltern role of facilitating implementation of the climate mitigation agenda, without many qualms about its ethical and social engineering implications.

The more recent emergence of a geoengineering discourse exhibits a more complex set of relationships between technoscientific and social scientific expertise. Scientists involved in geoengineering discourse convey mixed messages about the need for technocratic management of the Anthropocene at the same time as expressing strong commitments to the importance of public participation in decision making about geoengineering. On the other hand, at least some social scientists have characterised the emerging imaginaries of geoengineering (particularly SSA) in an essentialist fashion and adopted a critical stance towards what they see as a technological pathway that is incompatible with what, to us, seems to be an equally essentialist view of democracy. Many of the concerns about authoritarianism and social engineering directed at SSA apply equally well to conventional climate policy interventions.

We have offered an explanation of some social scientists' early, one might say premature, critical stance towards geoengineering in general, and SSA

in particular. The case for investigating geoengineering technologies was first made by a small section of the community of climate science experts. These actors often evoked the threats of climate change: for example warning of the perils of overstepping planetary boundaries, or crossing climate tipping points. In the earliest days, the natural scientists advocating SSA research seemed to suggest that the presence of such external pressures would mean that scientific expertise would have a much greater political role in deciding how societies (across the world) should react to the phenomenon of anthropogenic climate change. This line of argument invited critical questions about the distribution of political power and the possibility of authoritarianism. Thus the natural scientists made themselves and their pro-geoengineering arguments targets for criticism from social scientists sceptical about the idea of geoengineering, and in particular, SSA.

However, at present, the criticisms offered by such social scientists seem premature in assuming the final shape of geoengineering technologies, particularly SSA. Furthermore, the claim that SSA is inherently undemocratic is contestable. Just as appeal to scientific facts does not determine what political responses should be, a technology does not automatically require a certain political set-up in order to operate. Moreover, the claim that SSA is inherently undemocratic draws on a particular conception of democracy modelled on independent communities where citizens are highly engaged and actively involved in their community's decision-making. However, this conception of democracy and its contestability is not always made explicit by social scientists investigating public perceptions of geoengineering. In such cases it is difficult to decide whether their research is accurately reporting public perceptions as they are given, and if not, whether it constitutes a desirable "opening up" of debate, or an undesirable case of "stealth advocacy" aimed at closing down the SSA option.

The same conception of democracy is associated with the egalitarian voice

described by Cultural Theory. This helps account for the relatively uncritical stance taken towards the authority of natural and engineering sciences in the mainstream climate discourse - and especially the lack of objection to global institutions in which expert advice would dominate. In the mainstream climate discourse, the egalitarian voice allied with the hierarchical voice, which is respectful of expert authority in any sphere, including the political. From the egalitarian perspective, it was expedient to be silent about potentially unequal distributions of political power in return for acceptance, by the hierarchical perspective, of the idea that the planet upon which humans live is complex and fragile, and that humans' consumption of the planet's resources must be therefore reduced. The idea of geoengineering implies that planet Earth is complex but nevertheless manageable by humans. This is in accordance with the hierarchical conception of nature, but is an anathema to the egalitarian viewpoint. Therefore, as geoengineering is increasingly discussed, there is less incentive for the egalitarian voice to ally with the hierarchical one. Accordingly, we may expect to see more criticism of global institutions and scientific power when geoengineering is discussed than when similar political changes and institutions were discussed in pre-geoengineering mainstream climate discourse.

Notes

¹ An Elsevier journal entitled *Anthropocene* has yet to publish a first issue, but some papers are already available on the website with DOI codes. See <http://www.sciencedirect.com/science/journal/aip/22133054>

² Whether the problems associated with previous technological innovations, such as weather modification or biotechnology can be applied simply to the debates about geoengineering is another area in which some social scientists are insufficiently critical.

³ An equally problematic tendency is to present concerns specific to SSA as problems of “geoengineering”, when that category encompasses a diverse set of imaginary technologies including other SRM methods and CDR technologies.

⁴ Some interpret this argument slightly differently: that Caldeira and Keith do not argue that SSA research is the only way to avoid an emergency, but that research should be started now *if* later a climate emergency does manifest. They thus see these scientists as making a far more conditional claim and not predicting that a climate emergency will happen. While it is true that Caldeira and Keith say that a climate emergency is possibility, not a certainty, the article leaves it the reader in little doubt that research into SSA is a necessity anyway. SSA is presented as the *only* course of action that could avert a climate emergency (should one happen). Therefore, if we are concerned about climate emergencies (which we should be, as there is at least some risk) we should engage in SSA research – and start now.

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