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Ambivalent climate of opinions: Tensions and dilemmas in understanding geoengineering experimentation

Shinichiro Asayama [a,*], Masahiro Sugiyama [b], Atsushi Ishii [c]

[a] Center for Social and Environmental Systems Research, National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan
[b] Policy Alternatives Research Institute, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan
[c] Center for Northeast Asian Studies, Tohoku University, 41, Kawauchi, Aoba-ku, Sendai, Miyagi 980-8576, Japan

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ABSTRACT

Due to the fear of the consequences of climate change, many scientists today advocate the research into—but not deployment of—geoengineering, large-scale technological control of the global climate, to reduce the uncertainty around its efficacy and harms. Scientists propose in particular initiating field trials of stratospheric aerosol injection (SAI). This paper examines how the meanings of geoengineering experimentation, specifically SAI field trials, are reconfigured in the deliberation of the lay public. To this end, we conducted focus groups with Japanese citizens in June 2015 on the geoengineering concept and SAI field trials. Our main findings are as follows: the 'climate emergency' framing compelled the lay public to accept, either willingly or reluctantly, the need for 'geoengineering research'; however, public discourse on SAI field trials was *ambiguous* and *ambivalent*, involving both tensions and dilemmas in understanding what the SAI field trial is for and about. Our results exhibit how the lay public wrestles with understanding the social, political, and ethical implications of SAI field trials in multiple dimensions, namely, *accountability*, *controllability*, *predictability*, and *desirability*. The paper argues that more clarity in the term 'geoengineering research' is needed to facilitate inclusive and pluralistic debates on geoengineering experimentation and not to preemptively arrive at a consensus that 'we need more research.' We conclude that ambivalence about both the pros and cons of geoengineering experimentation seems to be enduring; thus, instead of ignoring or repressing it, embracing ambivalence is required to keep the geoengineering debate democratic and inclusive.

1. Introduction

In the last decade, the idea of deliberate manipulation of the earth's climate to counteract anthropogenic climate change, known as geoengineering or climate engineering, has been increasingly incorporated into the mainstream climate debate as a potential response option (IPCC, 2012, 2014). However, the prospect of geoengineering frightens people because such manipulation of the nature generates deep uncertainty over the climate system, and therefore might result in unintended, unpredictable, and uncontrollable negative—potentially catastrophic—consequences (e.g. Robock, 2008). Geoengineering may fundamentally alter the relationship between human and nature or significantly undermine political efforts toward mitigating climate change, which has induced strong ethical condemnation (e.g., Hamilton, 2013; Gardiner, 2010). Despite these downsides, geoengineering creates an "atmosphere of hope" (Flannery, 2015), a feeling that it is the only option that may ward off dangerous climate change. The vision of geoengineering is emotionally anchored between hopes and fears, and is imbued with ambivalence about the choice of futures (Asayama, 2015).

The term 'geoengineering' is used to cover a diverse and heterogeneous group of putative technologies, commonly divided into two distinctive categories: solar radiation management (SRM) and carbon dioxide removal (CDR) (Royal Society, 2009). While SRM is to reduce incoming sunlight and reflect it back to space, CDR is to remove carbon dioxide (CO_2) from the atmosphere. Most geoengineering technologies are still hypothetical, existing so far only as computational imaginaries represented in climate models (Kravitz et al., 2013a,b), or as discursive realities in policy reports (Huttunen et al., 2015) and news media coverage (Nerlich and Jaspal, 2012; Anshelm and Hansson, 2014a,b; Luokkanen et al., 2014). Geoengineering is not (yet) a physically-tangible technological object, so what constitutes geoengineering? It is the very idea that humans attempt to technologically control the global climate,

* Corresponding author.
E-mail address: asayama.shinichiro@nies.go.jp (S. Asayama).

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i.e., the provision of setting a global thermostat for the planet (Hulme, 2014). Because it essentially places the earth itself on an experimental stage, geoengineering can be seen as a discourse of *experimentation*.

The case of the SPICE (Stratospheric Particle Injection for Climate Engineering) project in the UK illustrates the experimentality of geoengineering. The SPICE project attempted to conduct a field experiment of geoengineering, though it was eventually canceled due to a conflict of interest related to a patent application. The SPICE trial was experimental in many senses, not only because it was the UK's first field test of geoengineering technology but also, and more importantly, because it was a social experiment that involved extra-scientific scrutiny, such as public engagement exercises with lay citizens (Pidgeon et al., 2013; Stilgoe et al., 2013a; Stilgoe, 2015). The SPICE case indicates that engaging the public in geoengineering is part of "an experimental system [of geoengineering] in which knowns and unknowns are negotiated, in public discourse and in research projects" (Stilgoe, 2016, p. 853; see also Bellamy and Lezaun, 2015).

There is now a chorus of scientists calling for 'more research' on geoengineering. Scientists are especially proposing to start field trials of stratospheric aerosol injection (SAI), a technology that involves spraying reflective particles into the stratosphere to reduce solar radiation, and which is considered one of the most emblematic geoengineering technologies (Hulme, 2012). However, field experiments of SAI are subject to controversial debates, can be seen as an archetype of "post-normal science" (Funtowicz and Ravetz, 1993) that requires wider public consultation with various stakeholders and lay citizens (Carr et al., 2013; Sugiyama et al., 2017).

This study examines how the meanings of geoengineering exp erimentation—specifically, SAI field trials—are rearticulated and reimagined as public discourses in the lay public's deliberation. We conducted focus groups with Japanese citizens on the very idea of geoengineering and on the proposal of SAI field trials. Our results show how the lay public wrestled to understand the experimentality of SAI field trials in multiple ways, and faced a dilemma between hopes and fears for technological experiment of our climate and society.

As we will discuss later, lay public discourse on geoengineering experimentation abounded in *ambiguity* and *ambivalence*. Although both ambiguity and ambivalence have something to do with uncertainty and unclearness, ambiguity is rather about incomplete knowledge or *epistemic* pluralities (e.g. framings, perspectives, assumptions) (Stirling, 2007), while on the other hand, ambivalence is more related to conflicts of values, worldviews or *normative* judgments. In this paper, we refer to 'ambiguity' as that deals with vagueness or indeterminacy resulted from plural and contended meanings, and to 'ambivalence' as that indicates attitudinal inconsistency in which people are "actively struggling to formulate opinions incorporating contradictory normative positions" (Cairns and Stirling, 2014, p. 31).

2. Background

2.1. Call for 'more research' on geoengineering

The debate on geoengineering is surrounded by controversy. This controversy concerns not only the risks and benefits brought into by geoengineering but also people's worldviews, i.e., "the kinds of world [geoengineering] deployment would bring into being" (Macnaghten and Szerszynski, 2013). There is a fundamental disagreement in "epistemic cultures" (Rayner, 2015), related to whether we should deliberately intervene in the climate. Despite this irreconcilable clash of values, the geoengineering debate by and large has converged into a call for 'more research' on geoengineering (Anshelm and Hansson, 2014b; Huttunen et al., 2015). Reports from both the UK Royal Society and the US National Research Council highlighted that geoengineering is no substitute for mitigation and adaptation; at the same time, both reports acknowledged the potential usefulness of geoengineering and hence recommended 'more research' to figure out whether geoengineering can be a viable option in the future (Royal Society, 2009; NRC, 2015).

Importantly, this advocacy of geoengineering is not for deployment but for *research* (Linnér and Wibeck, 2015). Given the significant potential risks pertaining to geoengineering, scientists usually consider it as a non-ideal or undesirable option (Robock, 2008). However, they do not rule out the possibility of geoengineering because of their anxiety about catastrophic climate change. Thus, scientists often take an ambiguous *and* ambivalent attitude toward geoengineering, citing both its benefits and its risks and remaining undetermined with regard to its deployment (Scholte et al., 2013; Huttunen et al., 2015; Hansson, 2014; Linnér and Wibeck, 2015). This ambivalence can easily turn into the well-worn scientist cliché that 'we need more research' because there is huge uncertainty over geoengineering.

The discourse of 'more research' is underpinned by our ignorance (Rayner, 2015). Whether supporting or opposing further research into geoengineering, we can all agree that our knowledge of how geoengineering technologies would work is inadequate. A lack of knowledge doesn't immediately justify the research into geoengineering; we still can choose not to research it (Hulme, 2014). However, under the circumstance with profound uncertainty, the call for 'more research' sounds straightforward and discreet, at least for scientists, because 'more research' could also lead to our abandoning geoengineering options if it became clear that the risks of geoengineering far outweighed its benefits. This perspective presupposes that research and deployment of geoengineering are separable, and therefore should be separated (e.g., Cicerone, 2006). Because of our ignorance, scientists usually consider that 'more research'—but not deployment—can be justifiable for advancing our understanding of geoengineering. In short, it is argued that "ignorance is not an option" (McNutt, 2015).

As such, the call for 'more research' is built on a widespread assumption (or faith) among scientists that 'more research' can reduce uncertainty (or produce 'more knowledge'), so that we can make better decisions in the future (e.g., Keith, 2013; Robock, 2012). This assumption is problematic because it would reproduce a linear model of the science–policy interface (e.g., Pielke, 2007; Beck, 2010) and reinforce the scientism that supposes 'more knowledge' can provide a decisive answer to social problems, thus defusing political controversy and public opposition by leaving normative questions untouched (e.g., Wynne, 2001). Nonetheless, the rhetoric of 'more research' is so powerful and thereby repeatedly used when scientists are tempted to convince policymakers and other stakeholders and to gain wider public support. The question is then often framed in terms of *how* we should do research but not *whether* we should do research. Scientists have taken the necessity of geoengineering research for granted by imagining the speculative future of catastrophic climate change, and also by rhetorically distinguishing research from deployment. So, the pressing issue lying on scientist's minds is how we can responsibly govern geoengineering research (cf. Dilling and Hauser, 2013).

Altogether, from the scientist's point of view, the need for 'more research' on geoengineering seems indisputable. Lay citizens may find it irrefutable, or at least hard to argue against scientists calling for 'more research,' especially when the argument is framed in the context of 'climate emergency' (Corner et al., 2011), because it is a normative call for taking action against climate change and does