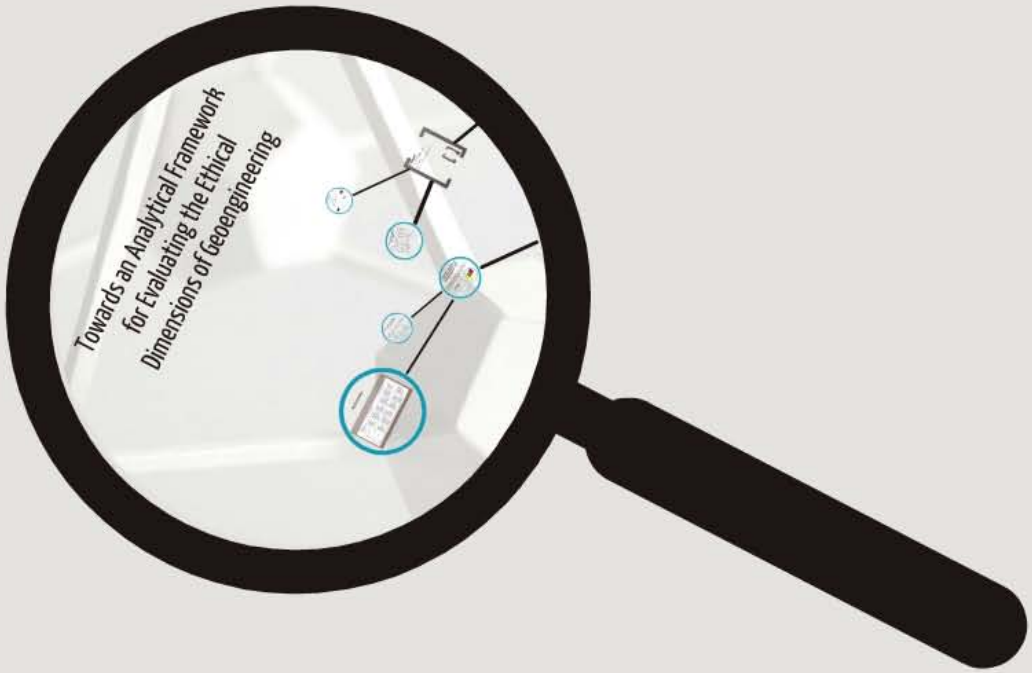
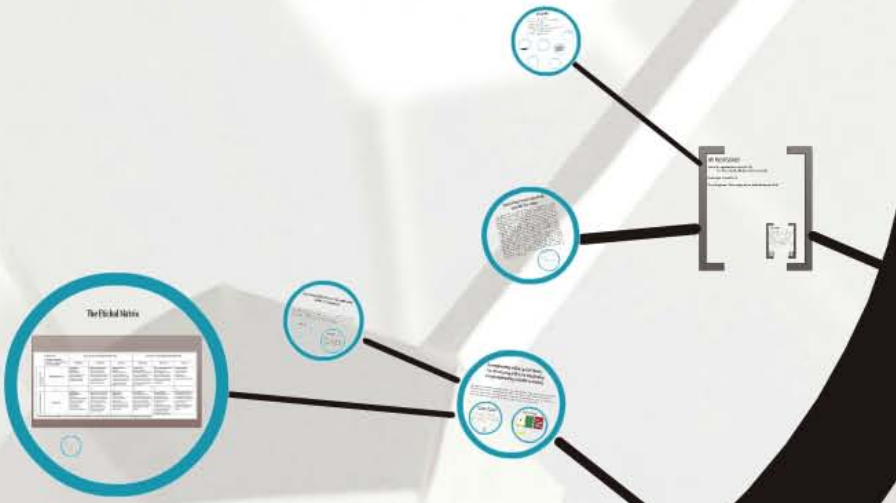
Post-normal science and its ethical aspects - Doctoral projects and other projects in the making

Post-normal science and its ethical aspects - Doctoral projects and other projects in the making



Towards an Analytical Framework for Evaluating the Ethical Dimensions of Geoengineering

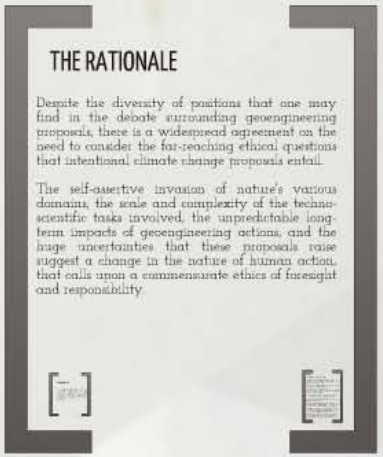


MY PhD RESEARCH

Advisors: Dr. Angela Guimaraes Pereira (EC-JRC)
Prof. Viriato Sormenho-Marques (University of Lisbon)

Research grant awarded: EC-JRC

Doctoral Programme: "Climate Change and Sustainable Development Policies"



THE RATIONALE

Despite the diversity of positions that one may find in the debate surrounding geoengineering proposals, there is a widespread agreement on the need to consider the far-reaching ethical questions that intentional climate change proposals entail.

The self-assertive invasion of nature's various domains, the scale and complexity of the techno-scientific tasks involved, the unpredictable long-term impacts of geoengineering actions, and the huge uncertainties that these proposals raise suggest a change in the nature of human action, that calls upon a commensurate ethics of foresight and responsibility.

THE OBJECTIVE

To develop an analytical framework that can contribute to better understand the social, legal and ethical issues raised by geoengineering proposals and that can be used in the development and implementation of appropriate governance mechanisms to steer both geoengineering research and deployment.

THUS...

THE SPECIFIC OBJECTIVES ARE:

- to better understand the theoretical assumptions, motivations, and interests related with the development of different geoengineering methods;

- to identify and critically analyse the goals and visions that shape geoengineering technologies;

- to explore and disentangle the imaginaries, commitments, and representations of nature and of the human being that inform geoengineering debates;

- to scrutinize the expectations, the embedded values and ways of making meaning of a geoengineered world;

- to provide descriptions of the ethical and social concerns in the field of geoengineering;

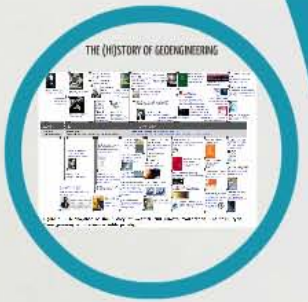
- to explore different ethical frameworks that can be used to guide the resolution of ethical problems and moral dilemmas arising from geoengineering research and deployment;

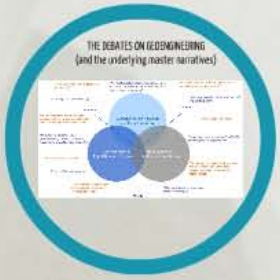
- to establish an integrated approach to promote discussion and provide general guidelines for ethically responsible decision-making in the field of geoengineering;

- to lay the foundation for a comprehensive analytical framework through which the social and ethical issues raised by geoengineering proposals could be examined.

THE METHODS

- Literature review
- Discourse/Narrative analysis
- Media analysis
- Blogosphere analysis
- Ethical analysis and evaluation
- Visual methodologies
- Public engagement

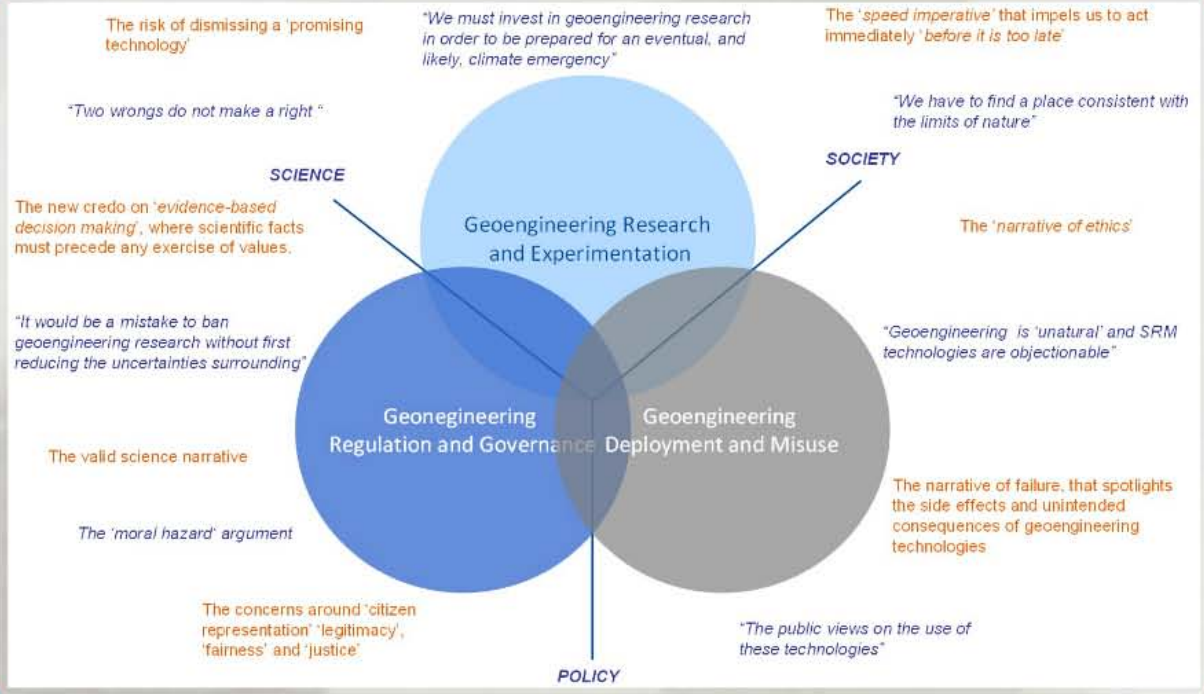




THE (HI)STORY OF GEOENGINEERING

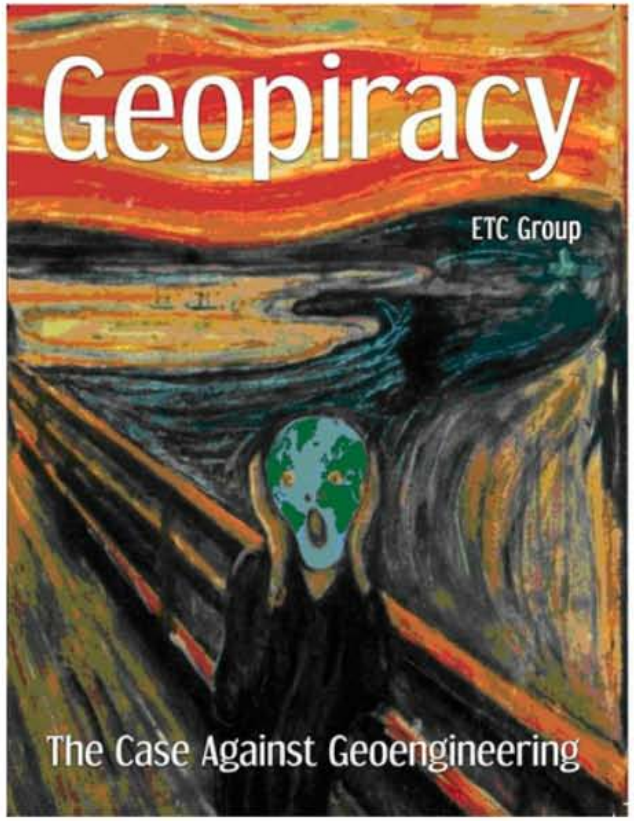
Figure 1 – A snapshot of the history of weather and climate modification. The third cycle: Geoengineering within a 'new scientific paradigm'.

THE DEBATES ON GEOENGINEERING
(and the underlying master narratives)



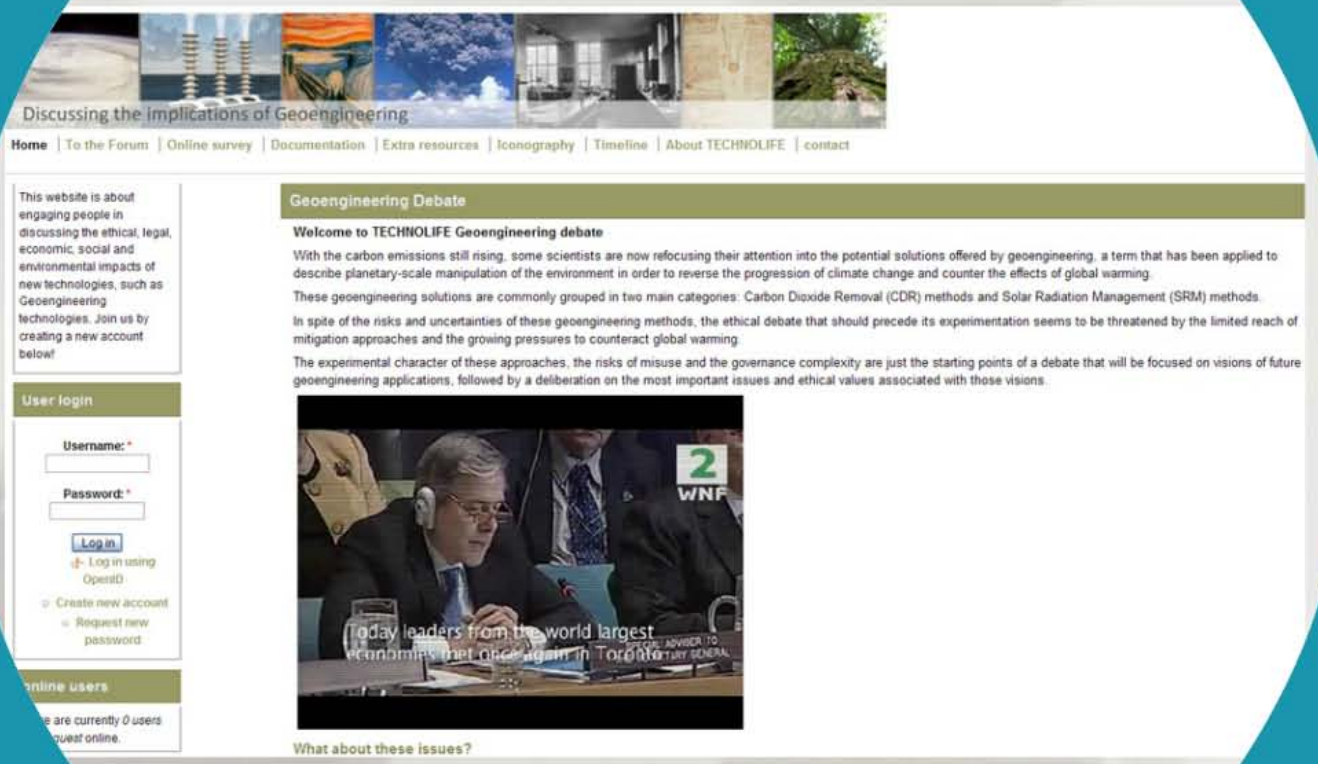
ETHICAL QUESTIONS IN GEOENGINEERING

THE VISUAL ANALYSIS
(Ethics and the Visual; Visual Narratives; Visual Rhetoric)



Source: ECT Group (2010). *Geopiracy - The Case Against Geoengineering*. L. Marshy. Ottawa, Canada, ECT Group: 56.

THE PUBLIC ENGAGEMENT
(The online debate)



BLOGOSPHERE ANALYSIS

GOOGLE GROUPS - GEOENGINEERING

06/04/2012 - Ethics of Geoengineering (anything new?)

Having but an undergraduate degree in Philosophy, you can forgive me for asking stupid questions, but ...

Does geoengineering raise any ethical issues not already considered by historical figures such as Aristotle, Hume, Kant, and so on?

Isn't the ethics of making decisions that affect others not involved in making the decisions a problem as old as humanity?

I just don't understand how there is anything new here for philosophy.

Surely there are difficult decisions to be made with moral dimensions, but I just can't imagine how geoengineering could pose fundamentally new philosophic problems.

Perhaps someone can compensate for my failure of imagination and tell me in what way geoengineering poses fundamentally new philosophic problems not previously addressed.

_____
Ken Caldeira

Carnegie Institution Dept of Global Ecology
260 Panama Street, Stanford, CA 94305 USA
+1 650 704 7212 kcal...@carnegie.stanford.edu
http://dge.stanford.edu/labs/caldeiralab @kencaldeira

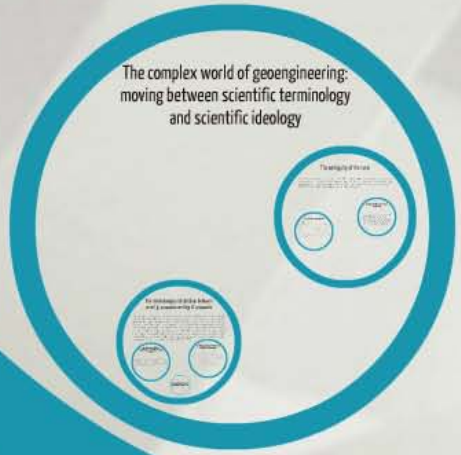
Questioning the Geoengineering Scientific Worldview

The possibility of 'geo-engineering' – large-scale climate modification as a strategy to offset an 'expected' major global climatic change – may not be that far off in the future () However, the risks of these climatic control measures must be considered along with any possible benefits that might be derived. First, in the face of the present theoretical uncertainties, any specific operation to compensate for an 'expected' climatic effect could conceivably produce an over-response in the system. It is quite possible with today's rather crude estimates that the magnitude of the 'expected' climatic perturbation could be overestimated. () if climatic deterioration were to follow climatic control operations, some nations could, in the absence of a definitive theory of climate, perceive that such climatic 'corrective' measures directly caused the deterioration. Thereby, these nations could demand restitution from the climate controllers, leading to a scenario in which the political –and possibly military – implications might be difficult to foresee' (S. H. Schneider & Temkin, 1978, p. 242).

Two fundamental questions

How will geoengineering technologies improve the human condition now and in the long term?

Why is geoengineering becoming a part of the portfolio of response options to anthropogenic climate change?



- The need to better understand the theoretical assumptions, motivations, and interests related with the development of different geoengineering methods;

- The need for reflection on the goals and vision that shape geoengineering technologies;

- The necessity to explore and disentangle the imaginaries, commitments, and representations of nature and of the human being that inform geoengineering debates;

-The imperative to scrutinize the expectations, the embedded values and ways of making meaning of a geoengineered world.

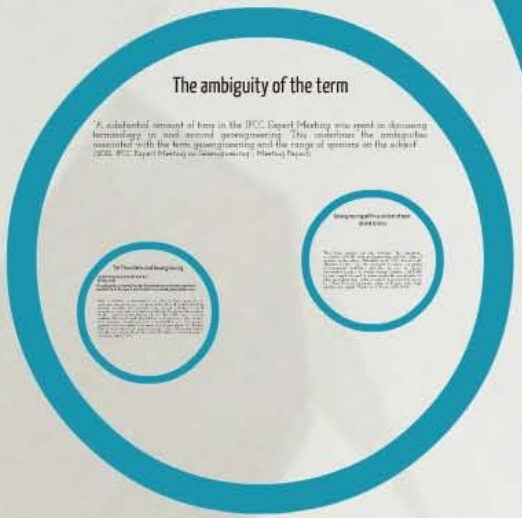
- The need to better understand the theoretical assumptions, motivations, and interests related with the development of different geoengineering methods;

- The need for reflection on the goals and vision that shape geoengineering technologies;

- The necessity to explore and disentangle the imaginaries, commitments, and representations of nature and of the human being that inform geoengineering debates;

-The imperative to scrutinize the expectations, the embedded values and ways of making meaning of a geoengineered world.

The complex world of geoengineering: moving between scientific terminology and scientific ideology



The ambiguity of the term

"A substantial amount of time in the IPCC Expert Meeting was spent in discussing terminology in and around geoengineering. This underlines the ambiguities associated with the term geoengineering and the range of opinions on the subject" (2012, IPCC Expert Meeting on Geoengineering - Meeting Report)

The Three Markers of Geoengineering

Global, Intentional and Unnatural Interventions
(Schelling, 1996)
- The scale (global or continental), the intent (the deliberate nature of the action rather than a side effect of it) and the degree to which the action is a countervailing measure (Keith, 2000)

Part, a number of interventions are already being proposed for combating climate change, and it is not clear that all of them should be classified together. For example, some suggest deflecting a small percentage of incoming radiation from the sun by placing large mirrors at the Lagrange point between it and the earth; some advocate fertilizing the oceans with plant life to soak up more carbon dioxide; some suggest a massive program of reforestation, and some propose capturing vast quantities of emissions from power plants and burying them in sedimentary rock deep underground. But do these interventions raise the same issues? Should we count all of them as "geoengineering"? (Gardiner, 2010, p. 285)

Geoengineering within a context of post-normal science

These three markers not only translates the ambiguities associated with the term geoengineering and the range of opinions on the subject (Edenhofer, et al., 2012), but also calls attention to the way the increased awareness of global environmental problems and the pressure to favour incremental responses to climate change, combine with Earth System complexity and its many irreducible uncertainties, to place geoengineering within a context of post-normal science, i.e. "where facts are uncertain, values in dispute, stakes high and decisions urgent (Funtowicz & Ravetz, 1993, 1994b)

The Three Markers of Geoengineering

- Global, Intentional and Unnatural Interventions (Schelling, 1996)

- The scale (global or continental), the intent (the deliberate nature of the action rather than a side effect of it) and the degree to which the action is a countervailing measure (Keith, 2000)

> First, a number of interventions are already being proposed for combating climate change, and it is not clear that all of them should be classified together. For example, some suggest deflecting a small percentage of incoming radiation from the sun by placing huge mirrors at the Legrange point between it and the earth, some advocate fertilizing the oceans with plant life to soak up more carbon dioxide, some suggest a massive program of reforestation, and some propose capturing vast quantities of emissions from power plants and burying them in sedimentary rock deep underground. But do these interventions raise the same issues? Should we count all of them as "geoengineering"? (Gardiner, 2010, p. 285)

Geoengineering within a context of post-normal science

These three markers not only translates "the ambiguities associated with the term geoengineering and the range of opinions on the subject" (Edenhofer, et al., 2012), but also calls attention to the way the increased awareness of global environmental problems and the pressure to favour incremental responses to climate change, combine with Earth System complexity and its major irreducible uncertainties, to place geoengineering within a context of post-normal science, i.e. "where facts are uncertain, values in dispute, stakes high and decisions urgent"(Funtowicz & Ravetz, 1993, 1994b)

The methodological distinction between small 'g' proposals and big 'G' proposals

But what if the object of your interest is not modular or encapsulated? What do you do then? For that, after all, is the feature that big 'G' geoengineering proposals have in common. They call for interventions on systems that lack just this characteristic. You cannot encapsulate part of the atmosphere and it is too complex to be able to build a realistic non-virtual model at scale. As such, it is reasonable to ask whether we could ever have a sound basis for moving to full deployment of any such proposed intervention. And if not, then why bother to even research such proposals in the first place? (Bunzl, 2009, p. 2).

Questioning the "feasibility" of geoengineering research in light of its object of interest

When the result of a global climate model experiment is presented as a scientific evidence for understanding the importance of aerosols forcing on the climate system, this would agree with traditional conceptions of science.

However, when sulphate aerosols are presented for their capacity to counteract the climate forcing of growing CO2 emissions, this should be seen as a "hallmark of technoscience".

The shift from the "laboratory ideal" to the "field ideal of experimentation"

For understanding the new tasks and methods of science, we can fruitfully invert Latour's metaphor, and think of Nature as reinvading the lab. We see this in many ways, for example, our science-based technology, which for a while appeared to be a new man-made Nature dominant over the old, is now appreciated as critically depended on the larger ecosystem in which it is embedded, and that it risks destruction of itself if that matrix becomes seriously perturbed or degraded. (Funtowicz & Ravetz, 1993, pp. 742-744).

The laboratory ideal involves designing manipulated, well-controlled, isolated experimental systems, the field ideal acknowledges their complexity, blurred boundaries, and unpredictable responses to interventions. Field experimentation could hardly be called an alternative ideal if they had not undergone a reevaluation in the philosophy of science and a reassessment with regard to their social relevance (Schwarz & Krohn, 2011, p. 120).

The "modern age's triumphal world alienation"

[illegible]

Questioning the "feasibility" of geoengineering research in light of its object of interest

When the result of a global climate model experiment is presented as a scientific evidence for understanding the importance of aerosols forcing on the climate system, this would agree with traditional conceptions of science.
However, when sulphate aerosols are presented for their capacity to counteract the climate forcing of growing CO2 emissions, this should be seen as a "hallmark of technoscience".

The "modern ag

09, p. 2).

The shift from the "laboratory ideal" to the "field ideal of experimentation"

For understanding the new tasks and methods of science, we can fruitfully invert Latour's metaphor, and think of Nature as reinvading the lab. We see this in many ways; for example, our science-based technology, which for a while appeared to be a new man-made Nature dominant over the old, is now appreciated as critically depended on the larger ecosystem in which it is embedded; and that it risks destruction of itself if that matrix becomes seriously perturbed or degraded. (Funtowicz & Ravetz, 1993, pp. 742-744).

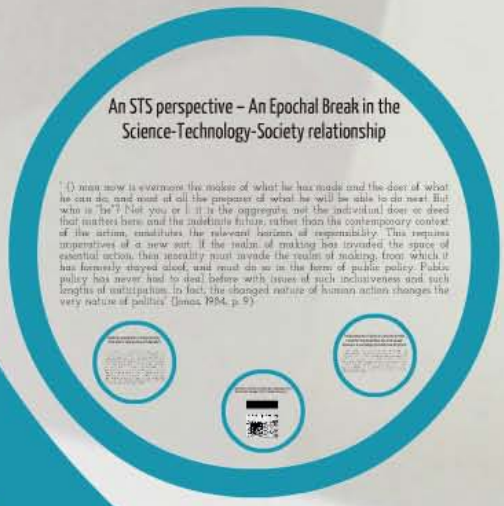
The laboratory ideal involves designing manipulated, well-controlled, isolated experimental systems; the field ideal acknowledges their complexity, blurred boundaries, and unpredictable responses to interventions. Field experimentation could hardly be called an alternative ideal if they had not undergone a reevaluation in the philosophy of science and a reassessment with regard to their social relevance (Schwarz & Krohn, 2011, p. 120):

The "modern age's triumphal world alientation"

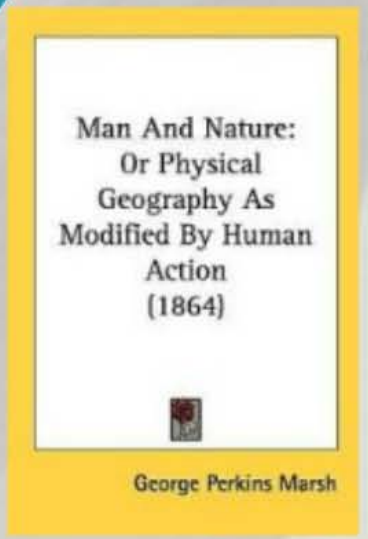
"At any event, while world alienation determined the course and the development of modern society, earth alienation became and has remained the hallmark of modern science. Under the sign of earth alienation, every science, not only physical and natural science, so radically changed its innermost content that one may doubt whether prior to the modern age anything like science existed at all".
(Arendt, 1958, p. 264)

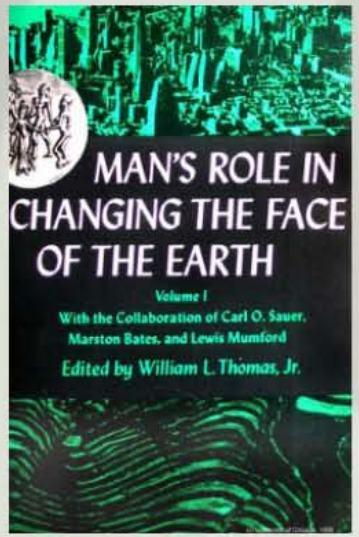
Geoengineering within Epochal Breaks - Two broad perspectives for questioning the geoengineering scientific worldview

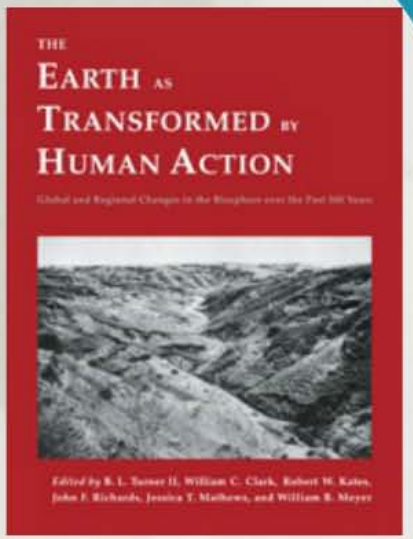
Looking at geoengineering from a more distant and detached vantage point presupposes considering it from a broad, long-term perspective, both in terms of the human-environment relationship, and in terms of the relationships between science, technology and society.



The Earth System Science Perspective - The Anthropocene: an Epochal Break on the Human-Earth relationship







The Anthropocene

"Unless there is a global catastrophe – a meteorite impact, a world war or a pandemic – mankind will remain a major environmental force for many millennia. A daunting task lies ahead for scientists and engineers to guide society towards environmentally sustainable management during the era of the Anthropocene. This will require appropriate human behaviour at all scales, and may well involve internationally accepted, large-scale geo-engineering projects, for instance to optimize climate. At this stage, however, we are still largely treading on terra incognita" (Crutzen, 2002).

The impetus for geoengineering that came from novel structural concepts of the Earth System science.

The "paradigm of stabilization":
"Why should Prometheus not hasten to Gaia's assistance? Geoengineering proposals have become popular as a way of mitigating the anthropogenic aberrations of the ecosphere. One interesting idea features iron fertilization of certain ocean regions to stimulate the marine biological pump which draws down CO_2. And Russian scientists are currently elaborating a repair scheme for the ozone layer using orbital lasers. But we can also think of proactive control of natural planetary variability: insights acquired during the present climate crisis may enable humanity to suppress future glaciation events by judicious injection of 'designer greenhouse gases' into the atmosphere" (H. J. Schellnhuber, 1999).

The impetus for geoengineering that came from novel structural concepts of the Earth System science.

The "paradigm of stabilization":
"Why should Prometheus not hasten to Gaia's assistance? Geoengineering proposals have become popular as a way of mitigating the anthropogenic aberrations of the ecosphere. One interesting idea features iron fertilization of certain ocean regions to stimulate the marine biological pump which draws down CO2. And Russian scientists are currently elaborating a repair scheme for the ozone layer using orbital lasers. But we can also think of proactive control of natural planetary variability: insights acquired during the present climate crisis may enable humanity to suppress future glaciation events by judicious injection of 'designer greenhouse gases' into the atmosphere" (H. J. Schellnhuber, 1999).

The Anthropocene

"Unless there is a global catastrophe – a meteorite impact, a world war or a pandemic – mankind will remain a major environmental force for many millennia. A daunting task lies ahead for scientists and engineers to guide society towards environmentally sustainable management during the era of the Anthropocene. This will require appropriate human behaviour at all scales, and may well involve internationally accepted, large-scale geo-engineering projects, for instance to 'optimize' climate. At this stage, however, we are still largely treading on terra incognita" (Crutzen, 2002).

An STS perspective – An Epochal Break in the Science-Technology-Society relationship

" () man now is evermore the maker of what he has made and the doer of what he can do, and most of all the preparer of what he will be able to do next. But who is "he"? Not you or I: it is the aggregate, not the individual doer or deed that matters here; and the indefinite future, rather than the contemporary context of the action, constitutes the relevant horizon of responsibility. This requires imperatives of a new sort. If the realm of making has invaded the space of essential action, then morality must invade the realm of making, from which it has formerly stayed aloof, and must do so in the form of public policy. Public policy has never had to deal before with issues of such inclusiveness and such lengths of anticipation. In fact, the changed nature of human action changes the very nature of politics" (Jonas, 1984, p. 9).

The discontinuities of both social and techno-scientific nature that have shaped the interactions between socioeconomic, technological and environmental systems

If one wishes to draw a distinctive line between the modern age and the world we have come to live in, he may well find it in the difference between a science which looks upon nature from a universal standpoint and thus acquires complete mastery over her, on one hand, and a truly "universal" science, on the other, which imports cosmic processes into nature even at the obvious risk of destroying her and, with her, man's mastership over her (Arendt, 1958, p. 268).

The differences and affinities intentional climate change proposals have with many other technologies that have emerged in the recent past

"All the News That's Fit to Print"

The New York Times.

LATE CITY EDITION

SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

HOFFA IS ELECTED TEAMSTERS HEAD; WARNS OF BATTLE

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device

Device Is 8 Times Heavier Than One Planned by U.S.

500 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

FALBUS COMPARES HIS STAND TO LEE'S

City Rate Predicted

ARGENTINA TAKES EMERGENCY STEPS

SATELLITE SIGNAL

Questioning Geoengineering: A changed nature by human action or a changed nature of human action?

" But the action of the scientists, since it acts into nature from the standpoint of the universe and not into the web of human relationships, lacks the revelatory character of action as well as the ability to produce stories and become historical, which together form the very source from which meaningfulness springs into and illuminates human existence. In this existentially most important aspect, action, too, has become an experience for the privileged few, and these few who still know what it means to act may well be even fewer than the artists, their experience even rarer than the genuine experience of and love for the world"(Arendt, 1958, p. 324).

The Social and Ethical Issues of Geoengineering: Outline of a Framework

"all approaches to geoengineering express an implied ontology (an embedded theory of who we are, how we are situated in the realm of being) and a presumed ethics (an embedded theory of how we ought to behave)" (Weiskel, 2012)

Geonegineering and the new Earth System science paradigm

"At the extreme ends of this imagery [the Antropocene] we identify two programmes that we here call 'management first' and 'ethics first'. The 'management first' approach draws upon the optimistic view of human control and self-determination embedded in Earth System thinking and focuses on options and caveats for technological fixes and geoengineering. () This extreme interpretation of the Anthropocene challenge finds its counter-point in the 'ethics first' approach. Humbled by the scale, complexity and vulnerability of the Earth System, this political programme highlights the need for a new ethical framework for Earth stewardship" (Lovbrand, et al., 2009).

Geoengineering within the broad concept of "Earth System Governmentality"*

With the ethical landscape of geoengineering already in place, we draw on previous efforts to identify the adequate frameworks for rational ethical analysis, in order to suggest an adaptation of the ethical matrix (B. Mepham, 2000; Ben Mepham, 2004; Ben Mepham, Kaiser, Thorstensen, Tomkins, & Millar, 2006) to consider, under the broad concept of "Earth System Governmentality", the current debate on the social and ethical aspects of geoengineering research and deployment

* "As indicated by the semantic linking of the words governing and mentality, governmentality deals with how we think about governing". (Lovbrand, et al., 2009)

The Etichal Matrix

	Respect for: Positions within the spectrum of Earth System Governmentality	Governance of Geoengineering Research			Governance of Geoengineering Deployment		
		Wellbeing	**Autonomy**	**Fairness**	**Wellbeing**	**Autonomy**	**Fairness**
End point of the spectrum	**Management First**	**Innovation Argument:** R&D into new technologies such as geoengineering triggers spin-offs and creates jobs.	**R&D first argument:** R&D should not be constrained; once technologies have been developed, a decision can be taken as to their implementation. (Gardiner 2009:7f)	**Argument from Survival:** Without technical counterbalances, climate change might endanger the survival of the entire human species. (Corner & Pidgeon 2010:32)	**Lesser-evil argumentation:** At some future point in time, the deployment of geoengineering methods could be the lesser of two evils, and we should prepare for that case ()	**Do-it-alone argument:** If necessary, CE technologies can be deployed by a small group of determined nations to the benefit of the entire world. (Ott 2010)	**Compensation:** In the case of compensation, intentional intervention is required. (Elliot 1982)
	(...)	(...)	(...)	(...)	(...)	(...)	(...)
End point of the Spectrum	**Ethics First**	**Unilateral Deployment:** R&D into geoengineering might lead to a unilateral deployment with catastrophic consequences. (Goodell 2010:195-7)	**No Informed consent:** R&D into CE requires (morally) a broad and well-informed consent of those potentially affected, which is not given (Jamieson 1996:329f;Ott 2010, Gardiner 2009:14f; Elliott 2010:19)	**Risk Transfer Argument:** By carrying out research into and planning for geoengineering, one passes on risks that arise today to future generations	**Capabilities:** The deployment of geoengineering leads to fewer people having the basic capacities required for leading a flourishing human life (Nussbaum and Sen 1993).	**Human Rights:** The deployment of geoengineering changes the global institutional and economic framework in such a way that human rights are recognized and realized to a lesser degree (Pogge 2002).	**Distributional effects:** The deployment of geoengineering leads to further worsening of the situation of the world's most disadvantaged people and nations (Rawls 1975).

The ethical matrix revisited: Towards an Analytical Framework for Evaluating the Ethical Dimensions of Geoengineering Proposals.

	Respect for: Positions within the spectrum of Earth System Governmentality	Governance of Geoengineering Research			Governance of Geoengineering Deployment		
		Wellbeing	Autonomy	Fairness	Wellbeing	Autonomy	Fairness
End point of the spectrum	**Management First**	**Innovation Argument:** R&D into new technologies such as geoengineering triggers spin-offs and creates jobs.	**R&D first argument:** R&D should not be constrained; once technologies have been developed, a decision can be taken as to their implementation. (Gardiner 2009:7f)	**Argument from Survival:** Without technical counterbalances, climate change might endanger the survival of the entire human species. (Corner & Pidgeon 2010:32)	**Lesser-evil argumentation:** At some future point in time, the deployment of geoengineering methods could be the lesser of two evils, and we should prepare for that case ()	**Do-it-alone argument:** If necessary, CE technologies can be deployed by a small group of determined nations to the benefit of the entire world. (Ott 2010)	**Compensation:** In the case of compensation, intentional intervention is required. (Elliot 1982)
	(...)	(...)	(...)	(...)	(...)	(...)	(...)
End point of the Spectrum	**Ethics First**	**Unlilateral Deployment:** R&D into geoengineering might lead to a unilateral deployment with catastrophic consequences. (Goodell 2010:195-7)	**No Informed consent:** R&D into CE requires (morally) a broad and well-informed consent of those potentially affected, which is not given (Jamieson 1996:329f;Ott 2010, Gardiner 2009:14f; Elliott 2010:19)	**Risk Transfer Argument:** By carrying out research into and planning for geoengineering, one passes on risks that arise today to future generations	**Capabilities:** The deployment of geoengineering leads to fewer people having the basic capacities required for leading a flourishing human life (Nussbaum and Sen 1993).	**Human Rights:** The deployment of geoengineering changes the global institutional and economic framework in such a way that human rights are recognized and realized to a lesser degree (Pogge 2002).	**Distributional effects:** The deployment of geoengineering leads to further worsening of the situation of the world's most disadvantaged people and nations (Rawls 1975).

The ethical matrix revisited: Towards an Analytical Framework for Evaluating the Ethical Dimensions of Geoengineering Proposals.

Thank you for your attention.

Thank you for your attention.

Questions?
Suggestions?
Comments?

Post-normal science and its ethical aspects - Doctoral projects and other projects in the making