Altonaer Stiftung für philosophische Grundlagenforschung

Post-normal science and its ethical aspects - Doctoral projects and other projects in the making > 18-20 September 2013

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Imag[in]ing Geoengineering - The Plausible and the Implausible

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Imag[in]ing Geoengineering – The Plausible and the Implausible

SUMMARY

KEYWORDS

- Geoengineering
- Plausible Reasoning
- Narrative Rationality
- Imag[in]ing
- Visual Analysis


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HOW PLAUSIBLE IS NEW ENVIRONMENTALISM?
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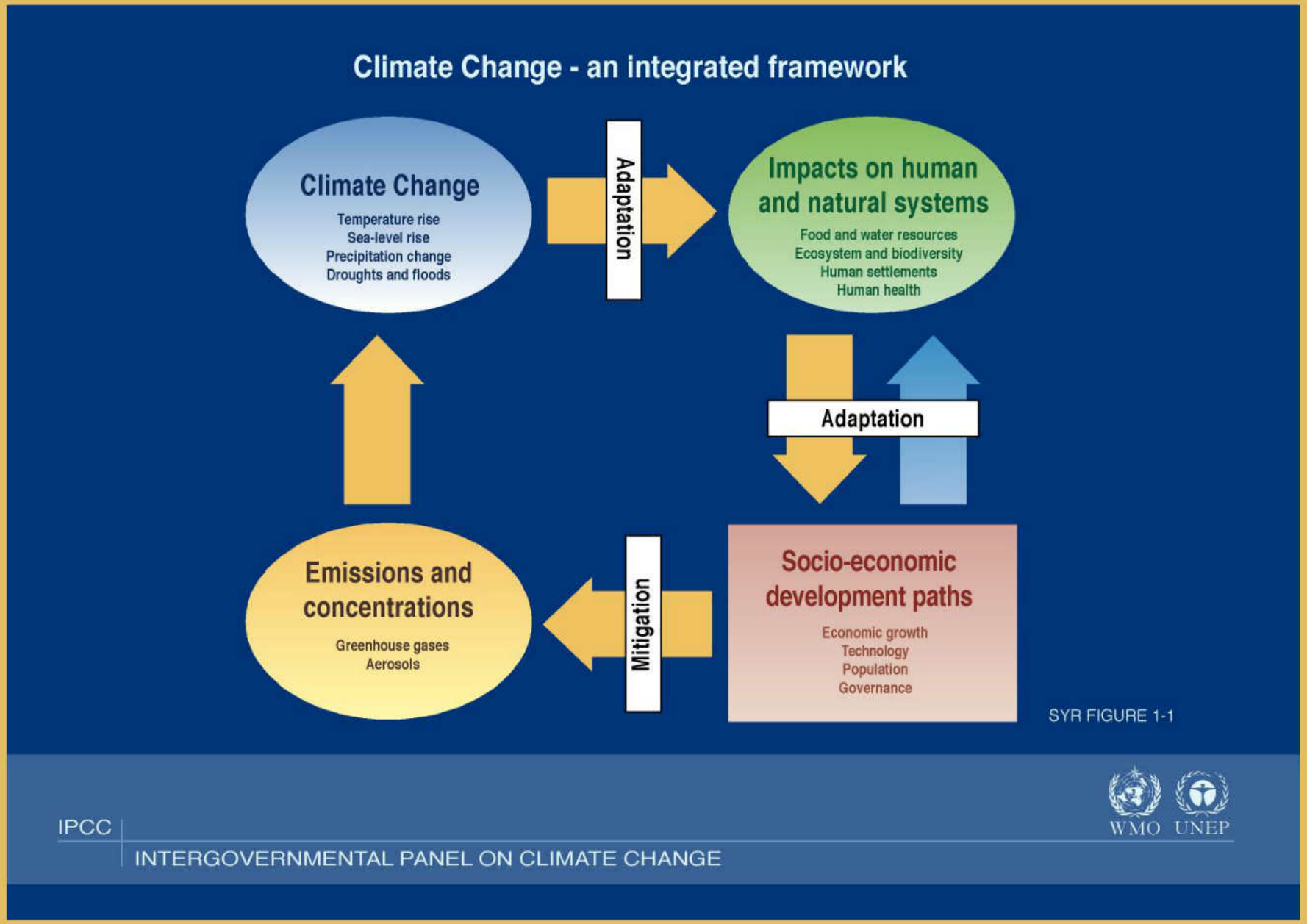
FINAL REMARKS

INTRODUCTION


Climate Change - an integrated framework
Climate Change
Temperature rise
Sea-level rise
Precipitation change
Droughts and floods
Adaptation
Impacts on human and natural systems
Food and water resources
Ecosystem and biodiversity
Human settlements
Human health
Adaptation
Emissions and concentrations
Greenhouse gases
Aerosols
Mitigation
Socio-economic development paths
Economic growth
Technology
Population
Governance
SYR FIGURE 1-1
IPCC
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
WMO UNEP


GEOENGINEERING
Geoengineering Responses to Climate Change
Scenario Planning for Solar Radiation Management
Yale Climate and Energy Institute
Donald G. White
Walter S. Mitchell
GEOENGINEERING
Technology and Governance
Assessments of Climate Engineering
Geoengineering:
Challenges and global impacts
COOL OPTIONS
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Integrated Assessment of Geoengineering Proposals
GEOENGINEERING OUR CLIMATE?
SRMGI
Solar Radiation Management Governance Initiative
Governance of Solar
diation Management Research
Q
The Climate Engineers
PILOT WORKSHOP ON GOVERNING GEOENGINEERING IN THE 21ST CENTURY: ASIAN PERSPECTIVES
18–19 July 2011
JAHRBUCH ÖKOLOGIE
Die Klima-Manipulateure
Geoengineering the climate
Science, governance and uncertainty
MARSILIUS KOLLEG
GLOBAL GOVERNANCE OF CLIMATE ENGINEERING
Hudson Institute
U.S. National Interest, Climate Engineering, and International Law
By Lee Lane
Cooling the Earth Through Solar Radiation Management
The need for research and an approach to its governance
Geo-Engineering Climate Change
ipcc
IPCC Expert Meeting on Geoengineering
Meeting Report
House of Commons
Science and Technology Committee
The Regulation of Geoengineering
Fifth Report of Session 2009-10
Geoengineering
HUNTER C. BARKLEY
SUCK IT UP
MARC GUNTHER
Engineering the Climate: Global Warming's Cheap, Effective Solution
HOW TO COOL THE PLANET
ASILOMAR INTERNATIONAL CONFERENCE ON CLIMATE INTERVENTION TECHNOLOGIES
March 22-26, 2010
A conference to develop risk assessment and management strategies for climate engineering research
GEOENGINEERING
GOVERNANCE RESEARCH
Policy Briefs
Engineering the Climate

Summary for Policymakers

- Lack of local capital is a key constraint for waste and wastewater management in developing countries and countries with economies in transition. Lack of expertise on sustainable technology is also an important barrier [10.6].

17. **Geo-engineering options, such as ocean fertilization to remove CO_2 directly from the atmosphere, or blocking sunlight by bringing material into the upper atmosphere, remain largely speculative and unproven, and with the risk of unknown side-effects. Reliable cost estimates for these options have not been published** *(medium agreement, limited evidence)* [11.2].

D. Mitigation in the long term (after 2030)

- Recent studies using multi-gas reduction have explored lower stabilization levels than reported in TAR [3.3].
- Assessed studies contain a range of emissions profiles for achieving stabilization of GHG concentrations[27]. Most of these studies used a least cost approach and include both early and delayed emission reductions (Figure SPM.7) [Box SPM.2]. Table SPM.5 summarizes the required emissions levels for different groups of stabilization concentrations and the associated equilibrium global mean temperature increase[28], using the 'best estimate' of climate sensitivity (see also Figure SPM.8 for the likely range of uncertainty)[29]. Stabilization at lower concentration and related equilibrium temperature levels advances the date when emissions need to peak, and requires greater emissions reductions by 2050 [3.3].

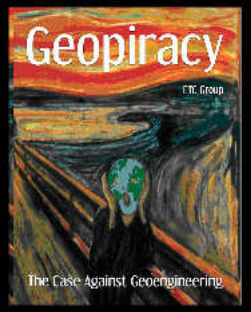
Expert Meeting

Current discussions that suggest geoengineering as an option to support climate mitigation efforts remain rather abstract and lack comprehensive risk assessments that take into account possible adverse impacts over short and longer time frames. The understanding of the physical science basis of geoengineering is still limited and IPCC will, for the first time, assess this in several chapters of the WGI contribution to AR5. Improved scientific understanding of the impacts of geoengineering proposals on human and natural systems will be assessed by WGII. WGIII needs to take into account the possible impacts and side effects and their implications for mitigation cost in order to define the role of geoengineering within the portfolio of response options to anthropogenic climate change. Furthermore, this includes an evaluation by WGIII of options for appropriate governance mechanisms.

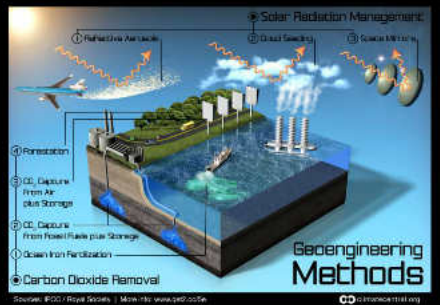
How plausible are current geoengineering proposals?

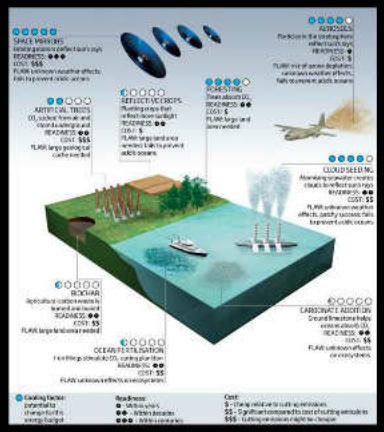
Is the plausibility of geoengineering due to the recent developments in the field, or is the broader context within which those developments are taking place the key element in understanding this shift?

What are the determinants of geoengineering plausibility?



The visual representations of geoengineering





Technoscientific Objects

The distinction between science and technoscience – an ontological difference that 'becomes more explicit when research results are presented in particular settings and when the objects of research are exhibited for the specific interest they hold'

Bensaude-Vincent, B., et. al. Patterns of Interest. The Objects of Research in Science and Technoscience. Journal for General Philosophy of Science. 2022. 53(2). p. 301-318

To explore the way geoengineering images convey plausible, or implausible, arguments about current proposals to intentionally modify the global climate and how a geoengineered world could be

Narrative rationality

"The concept of narrative rationality offers systematic principles, procedures, and criteria for assessing elements of discourse that provide warrants for believing or acting in particular ways"

Fisher, W.R., Human Communication as Narration: Toward a Philosophy of Reason, Value, and Action. 1987. Columbia: University of South Carolina Press.

Imag[in]ing

"The entanglement between imaging and imagining is the key to understanding what images do"

Rotenberg, M. and A. Rip, Entanglement of Imaging and Imagining of Nanotechnology. NanoEthics, 2011. 5(2): p. 155-165.

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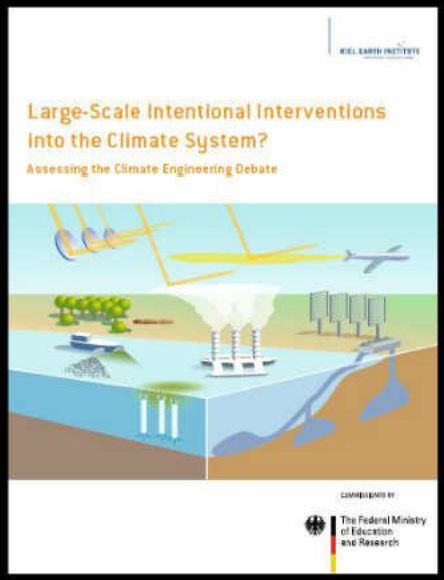
Bensaude-Vincent, B., et al., Matters of Interest: The Objects of Research in Science and Technoscience. Journal for General Philosophy of Science, 2011. 42(2): p. 365-383.

QUESTIONING THE PLAUSIBILITY OF GEOENGINEERING



Rickels, W., et al., Large-Scale Intentional Interventions into the Climate System? Assessing the Climate Engineering Debate. Scoping report conducted on behalf of the German Federal Ministry of Education and Research (BMBF). 2011, Kiel Earth Institute: Kiel.

"The current debate on climate engineering is far more complex and multilayered than a purely scientific-economic analysis would indicate. (...)
On the one hand, the arguments make use of empirical assumptions which can be assessed scientifically. On the other hand, they always rely on more or less far-reaching normative premises, as well. Such normative assumptions may involve the weighting of side-effects or the moral assessment of inequalities; in any case, they evade an empirical, scientific evaluation."

In the field of geoengineering, where knowledge is incomplete, uncertain, and inconsistent, the inductive and deductive arguments that one would expect to encounter in the scientific model of justification – the positivistic model of scientific verification of empirical and analytic propositions – seem to intermingle with a third class of arguments, the so-called abductive, presumptive, or plausibilistic forms of argumentation.

"Certainly, geoengineering seems to offer a plausible solution to the possibility of climate catastrophe in a way that attempting to reduce emission simply doesn't".

Morris, J., Which policy to address climate change?, in Climate Change Policy: Challenging the Activists, C. Robinson, Editor. 2008, The Institute of Economic Affairs: London. p. 132-158.

"Suppose, for example, that current political inertia on climate change is partly caused by a resistance to the kinds of norms of global justice and community that dealing with the problem might suggest. Then, it seems plausible that any geoengineering policy likely to emerge will be similarly constrained".

Gardiner, S., Some Early Ethics of Geoengineering: A Commentary on the Values of the Royal Society Report. Environmental Values, 2011. 20: p. 163-188.

"It is also plausible that a major country, suddenly experiencing a serious local or regional climate disaster such as prolonged drought, could decide to do SRM unilaterally, thus imposing its consequences on the entire planet."

Morgan, M.G. and K. Ricke, Cooling the Earth Through Solar Radiation Management: The Need for Research and an Approach to Its Governance. An opinion piece for the International Risk Governance Council (IRGC). 2010.

"I highlight the divergent results not to argue that one is more correct than other but to point out that in this case, two different research teams using very similar methods and just by varying assumptions about "deep uncertainties" arrived at results that are completely at odds with each other.

The conclusion, then, is that while it is certainly plausible that techniques of geoengineering could lead to very large benefits in relations to costs, it is also possible that those same techniques could lead to very large costs with respect to benefits."

Roger Pielke Jr., The Climate Fix. What scientists and politicians won't tell you about global warming. 2010, Philadelphia, PA: Basic Books.

The contexts in which the concept of plausibility has been used and the set of things it refers to not only reveal a very large class of plausibility reckonings deeply embedded in actual cognitive practice, but also expose the dual nature of plausibility in hypothetical reasoning

"Plausibility trisects reasoning in characteristic ways. We can conceive of the plausible as that which is reasoned from and as that which is reasoned to. We can also see it as characterizing the inference link between what is reasoned from and what is reasoned to. Seen this way, a piece of reasoning may have premisses that are plausible; it may have a plausible proposition as its conclusion; and its conclusion may be plausibly inferred from its premisses. It is also notable that plausibility is ambiguous as between propositions and what we might call the "engagement of propositions". The two are logically independent. Planck famously thought that his quantum hypothesis was radically implausible, but he conjectured it all the same, illustrating that it can sometimes be reasonable to accept (if only tentatively) the unreasonable. Given the linguistic tie between the reasonable and the plausible, a like concurrence affects the plausible. Accordingly we shall distinguish propositional plausibility from strategic plausibility."

Gabbay, D.M. and J. Woods, The Practical Turn in Logic, in Handbook of Philosophical Logic, D.M. Gabbay and F. Guenthner, Editors. 2005, Springer: Dordrecht, The Netherlands. p. 15-122.

This distinction points to the ambiguous cognitive and epistemic status of plausibility and highlights the importance of considering both the explanatory and instrumental aspects of abductive reasoning in the context of the geoengineering debate, where the two different kinds of plausible contentions (propositional and strategic plausibility) are being brought into play to answer two very different kinds of questions: What is it reasonable to believe? and What is it reasonable to do?

EXPLORING GEOENGINEERING PLAUSIBILITY THROUGH EXPANDED NOTIONS OF NARRATIVE

"Narrative truth is distinguished from other kinds of formal science truths by its emphasis on the life-like, intelligible and plausible story. Stories typically reflect a coherence (as opposed to correspondence) theory of truth in that the narrator strives for narrative probability – a story that makes sense; narrative fidelity – a story consistent with past experiences or other stories; and aesthetic finality – a story with satisfactory closure and representation appeal"

Sandelowski, M., Telling Stories: Narrative Approaches in Qualitative Research. Image-the journal of nursing scholarship, 1991. 23(3): p. 161-166.

While imaging refers to the creation of images based on data, aiming for resemblance and offering "a view on what is out there", imagining refers to the creation of impressions, offering visions of worlds that might be realised. Thereby, the word "imag(in)ing" aims at capturing the continuum between imaging and imagining, referring to something that has not only to do with the way an image may bear some resemblance to that which it represents, but also with the way it might "stands for" and is able to "act for". It thus refers to the realm of symbolic action, in the sense that these visual representations "have sequence and meaning for those who live, create, or interpret them" and might provide a meaning and a rationale for decision and action.

HOW PLAUSIBLE ARE THE OBJECTS OF GEOENGINEERING RESEARCH?

The pressure of practice under which science operates today is giving rise to the emergence of new objects of research – ambivalent beings, hybrid products and theoretically constructed objects through which we gain a new understanding and control of nature – that call for a more careful consideration of the complex narratives and practices of science and technology

Engelhaupt, E. (2010) Engineering a cooler Earth Science News 177, 12 DOI: 10.1002/scin.5591771220.

ASILOMAR INTERNATIONAL CONFERENCE
ON CLIMATE INTERVENTION TECHNOLOGIES
March 26, 2010
Statement from the Conference's Scientific Organizing Committee

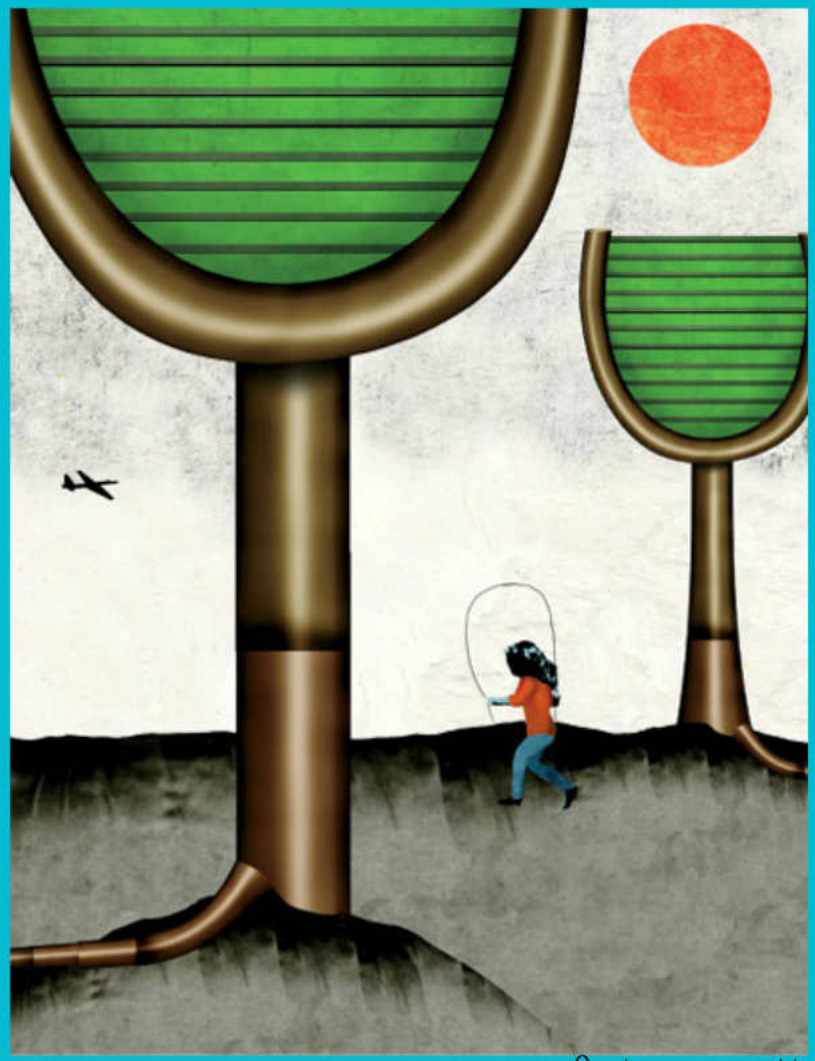
2.2.4 Carbon dioxide capture from ambient air

Air capture is an industrial process that captures CO_2 from ambient air producing a pure CO_2 stream for use or disposal. There is no doubt that air capture technologies could be developed (Keith *et al.* in press (a)). The technical feasibility of this is demonstrated, for example, by commercial systems that remove CO_2 from air for use in subsequent industrial processes. Several methods for air capture have been demonstrated at laboratory scale, although as yet no large-scale prototypes have been tested, and it remains to be seen whether any of these processes can be made sufficiently cost effective (Keith *et al.* in press (a)).

The most well-known air capture technology involves the so called "artificial trees" or "synthetic trees".

"Filtering machines - think of them as synthetic trees - can capture far more CO2 than natural trees of a similar size"

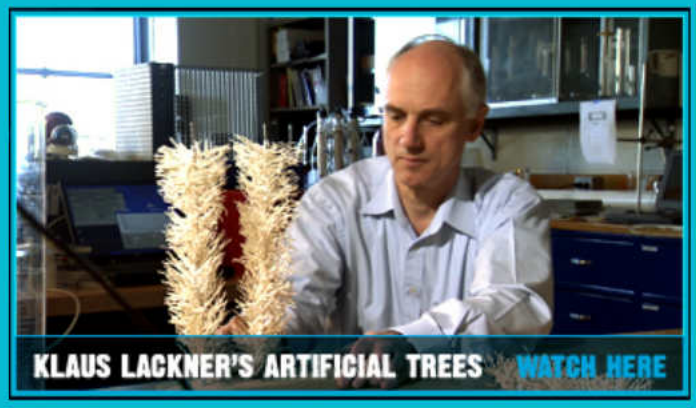
Lackner, K.S., Washing carbon out of the air. Scientific American, 2010. 302(6): p. 66-71.



Giant air-capture machines, such as artificial trees, could cleanse the atmosphere of excess carbon dioxide.
Credit: Michael Morgenstern.

"His prototype looks like a big furnace filter, with layers of ruffled leaves of permeable material coated with sodium carbonate. As the air wafts through the filter, the sodium carbonate will combine with the carbon dioxide to become sodium bicarbonate; periodically, a liquid will flush the leaves, washing the bicarbonate into solution. That solution will go to a separator, where electrodialysis will turn it back into carbon dioxide (for sequestration) and sodium carbonate (for reuse in the filter). A unit the size of a forty-foot shipping container standing on the end, says Lackner, would remove a ton of carbon dioxide a day"

Horn, M. and F. Krupp, Earth: The Sequel. The Race to Reinvent Energy and Stop Global Warming. 1st ed. 2008, New York: W. W. Norton & Company. 279.



http://www.pbs.org/wgbh/nova/tech/capturing-carbon.html

If "they don't exist yet, and when they do, they probably won't look like real trees", why are these objects portrayed to resemble real trees? Is it to provide an element that could ring true with our experiences, views, and beliefs (narrative fidelity and aesthetic functionality)? Is it to provide a satisfactory answer to some of the questions and concerns raised by the public about these technologies?

AIR CAPTURE

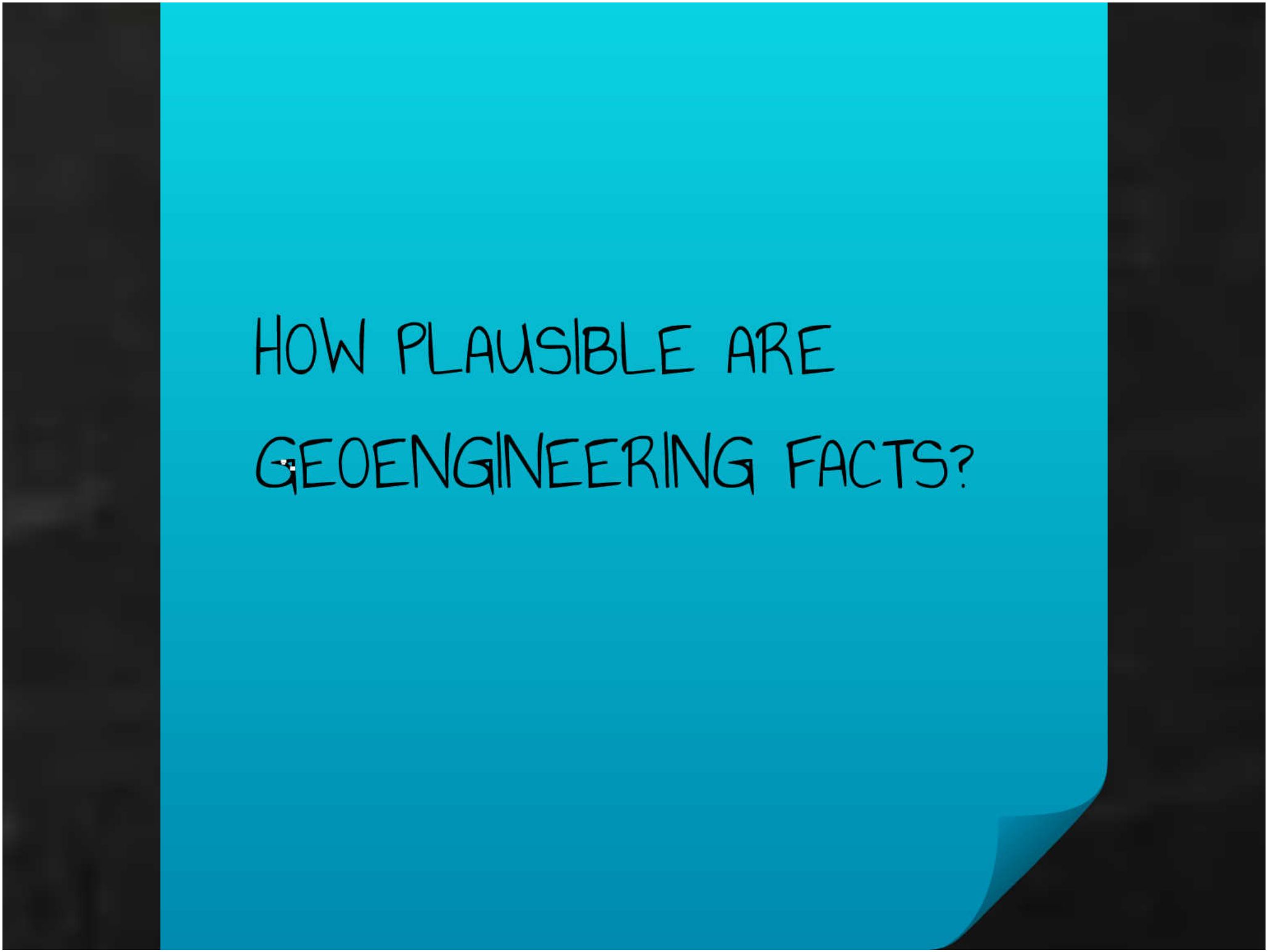
Disadvantages and concerns:

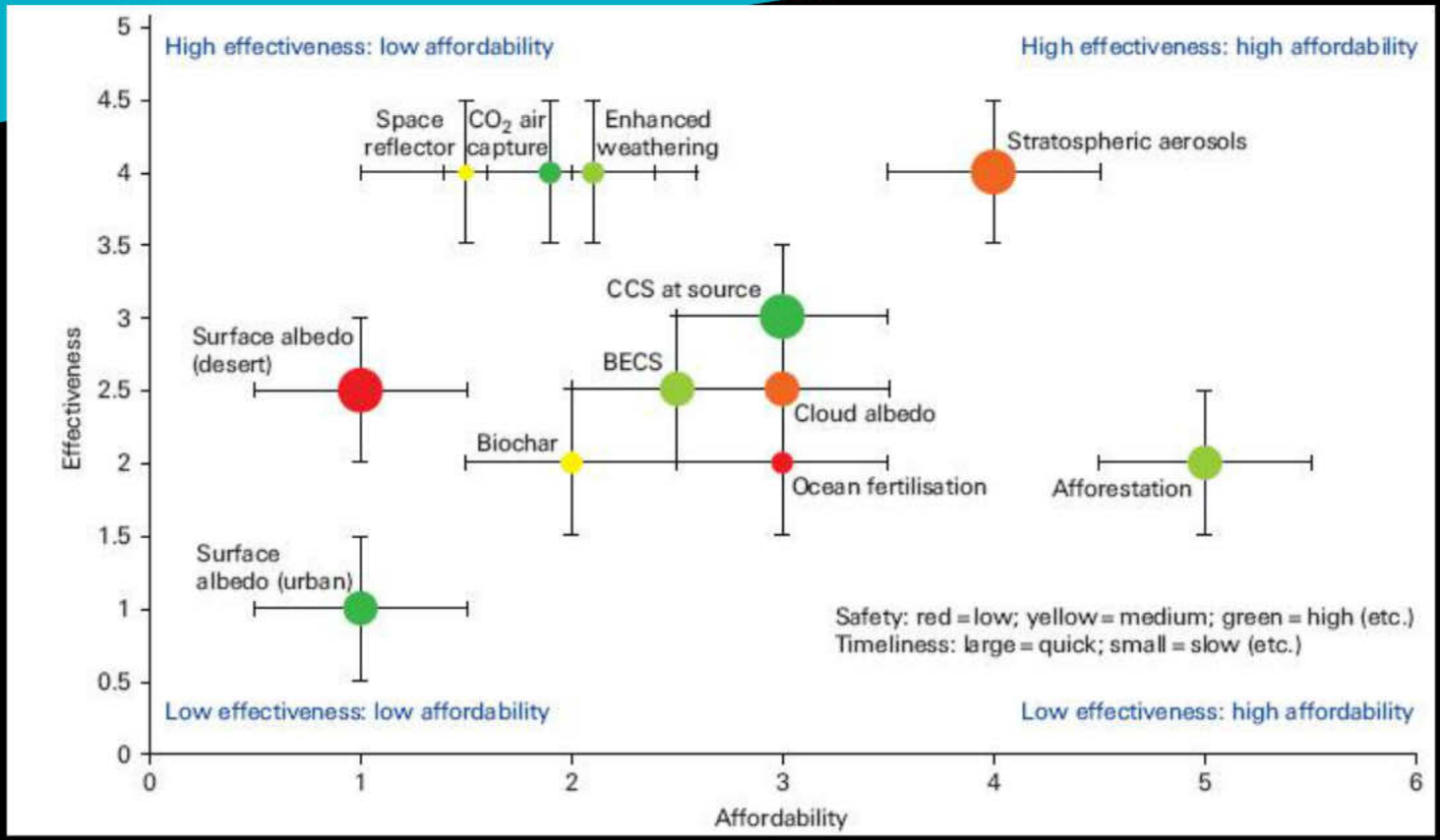
- The capture devices may be an eyesore and could take up land space.
- Visual appearance and potential noise.
- There are not many places to store CO_2 underground

Participant's questions to scientists:

- What is the process by which CO_2 is captured?
- How big would they be?
- What would they be made out of?
- Would there be health benefits for those living near them?

Some concerns and questions about air-capture technologies that emerged in a public dialogue on geoengineering conducted by the UK Natural Environment Research Council


HOW PLAUSIBLE ARE
GEOENGINEERING FACTS?



A preliminary overall evaluation of the geoengineering techniques considered in Chapters 2 and 3 of the Royal Society's report (p. 49).

"*The effectiveness of the methods is plotted against their affordability (the inverse of the cost for a defined magnitude of effect), with the size of the points indicating their timeliness (on a scale of large if they are rapidly implementable and effective, through to small if not), and the colour of the points indicating their safety (on a scale from green if safe, through to red if not). Indicative error bars have been added to avoid any suggestion that the size of the symbols reflects their precision (but note that the error bars are not really as large as they should be, just to avoid confusing the diagram). This diagram is tentative and approximate and should be treated as no more than a preliminary and somewhat illustrative attempt at visualising the results of the sort of multi-criterion evaluation that is needed. It may serve as a prototype for future analyses when more and better information becomes available*".

' (...) But the study does break new ground in attempting to rank the different contending technologies according to how effective they're likely to be, how much they're likely to cost, how safe they appear, and how quickly they could be deployed. So the most cost-effective, overall, is probably pumping dust into the upper atmosphere, mimicking the impact of volcanic eruptions that are known to produce a net cooling by reflecting sunlight back into space'.

Source: Black, R. (2009). "Plan B for Planet Earth." Retrieved 10/06/2013, from http://www.bbc.co.uk/blogs/thereporters/richardblack/2009/09/plan_b_for_planet_earth.html

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'This diagram provides a solid overview of the schemes the authors examined and their overall assessment of their effectiveness, timeliness, affordability and degree of risk'.

Source: Jacquot, J. (2009). "Focus on climate mitigation; give geoengineering a chance." Retrieved 10/06/2013, from http://arstechnica.com/science/2009/09/focus-on-climate-mitigation-give-geoengineering-a-chance/

'While the numbers assigned to effectiveness, affordability, safety and timeliness are somewhat qualitative (hence the error bars – which merely denote large uncertainties), this representation gives a sense of which geoengineering approaches might be the more promising ones. In crude terms, the ideal method would be represented by a large green circle to the upper right of the chart. Under these criteria, using stratospheric aerosols to scatter sunlight away from the earth comes closest to the ideal'.

Source: Maynard, A. (2009). "Geoengineering the climate: A clear perspective from The Royal Society" Retrieved 11/06/2013, from http://2020science.org/2009/09/01/geoengineering-the-climate-a-clear-perspective-from-the-royal-society/

'Reflective technologies could cool the planet within a year, and according to the Royal Society's findings the most promising method in terms of cost and effectiveness would be to pump sulphate particles into the stratosphere'.

Source: Brahic, C. (2009) "Top science body calls for geoengineering 'Plan B'", *New Scientist* Volume, 8 DOI: http://dx.doi.org/10.1016/S0262-4079(09)62312-5

'The authors rated various schemes on the basis of effectiveness, affordability, safety and timeliness, with estimates of uncertainty for the first two parameters. There were no clear winners: options that scored highly on effectiveness scored low on safety or cost, whereas those that were affordable and safe were less effective'.

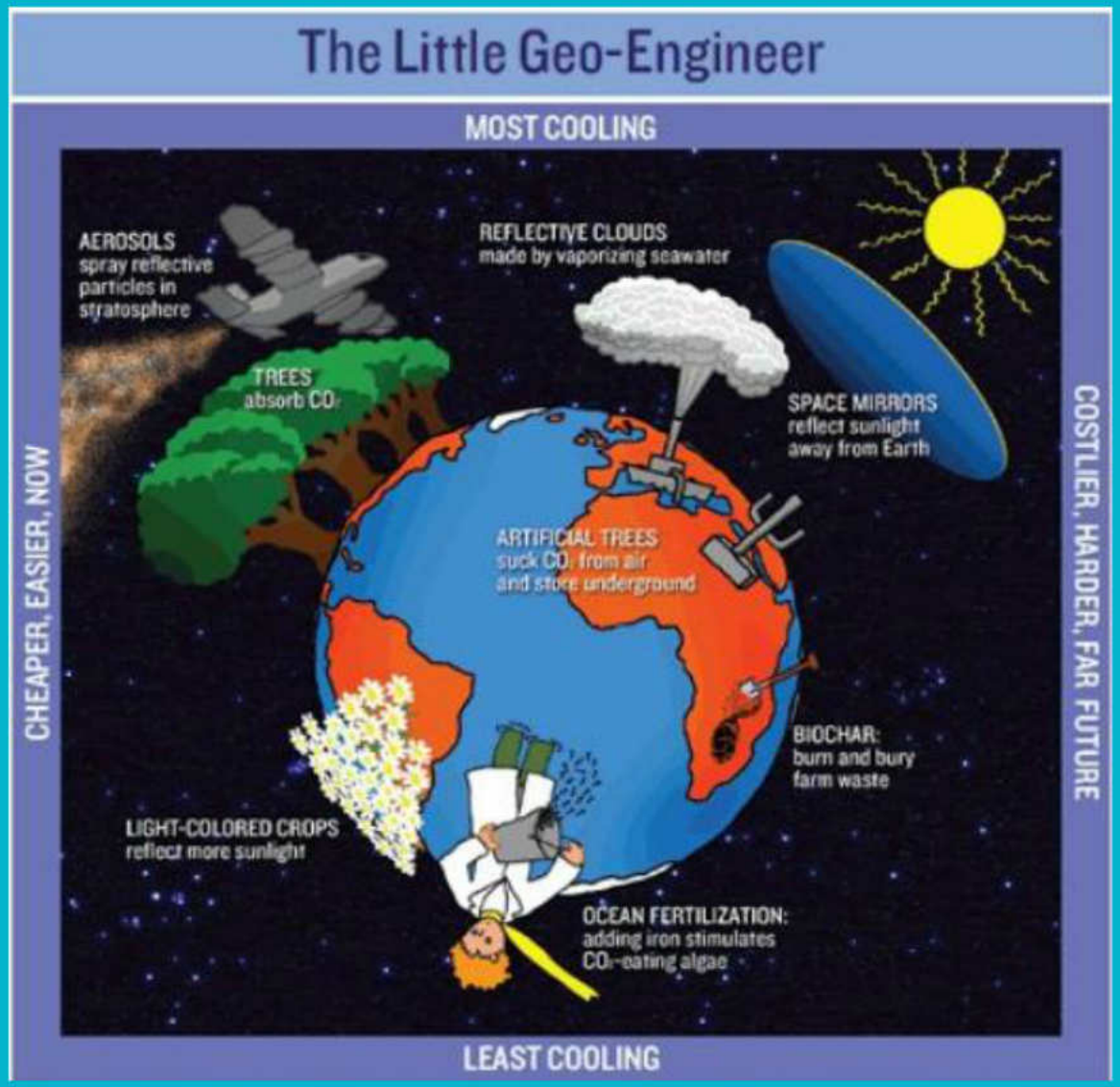
Source: Williamson, P. (2011). "Climate geoengineering Could we? Should we?", *Global Change*, 76 (January), 18-21. Retrieved 11/06/2013, from http://www.igbp.net/

Some quotations retrieved from the internet, with implicit or explicit reference to figure 5.1 of the Royal Society's report.

- the idea of "epistemically authoritative sources" as a substantive basis of plausibility
- the dissemination of knowledge, and the communication of science among professionals and to the public
- the intertextuality associated with this type of representation
- the roles that these kinds of images play in the process of knowledge production
- the paradoxes related to the visual representation of uncertainty
- the quantitative imperative versus the imperative of presuppositions
- the need to tackle the dilemmas of the science-policy interface, _ that is, the difficulty of accommodating the "growing expectations for science", which has to simultaneously address issues of policy relevance, scientific quality and legitimacy in a context where "facts are uncertain, values in dispute, stakes high and decisions urgent" [Funtowicz, S.and J. Ravetz, 1994].

HOW PLAUSIBLE IS NEW ENVIRONMENTALISM?

"Traditional environmentalism taught us to live humbly within nature's limits. A new environmentalism, which assumes we can't learn fast enough to live humbly, embraces geo-engineering ideas as our main hope for cooling the planet"



The Little Geoengineer.

Source: Wapner, P. (2010) Humility in a Climate Age. Tikkun Magazine.

By revealing the contradictions of a new environmentalism that ignores naturalism, the implausible story that portrays the little prince as a little geoengineer confronts us with a situation of aporetic inconsistency, i.e. a situation where a group of contentions seem individually plausible but are collectively incompatible.

"The problem is not that we are doing too much – pumping too much carbon into the atmosphere – but that we're doing too little – we are not working hard enough to alter the atmosphere"

Wapner, P.K., Living Through the End of Nature: The Future of American Environmentalism. 2011: MIT Press.

"We have been actively engaged in a massive programme of global geoengineering for many decades or centuries. We need to recognize this activity and change the way we think about the earth – not just our impact on the planet, but how (or if) we should manage the situation. (....) Once we recognize our environmental imperative to carefully and thoughtfully manage our planet for maintaining the health of all component earth systems and tackle the ethical issues of geoengineering, we can move away from accidental or poorly planned geoengineering into an era of conscious geodesign"

Artz, M. and J. Dangermond, A GIS-based Framework for Modelling and Global Design of Earth Systems, in Geoinformatics for Climate Change Studies, P.K. Joshi and T.P. Singh, Editors. 2011, TERI Press: New Delhi.

By revealing the contradictions of a new environmentalism that ignores naturalism, the implausible story that portrays the little prince as a little geoengineer confronts us with a situation of aporetic inconsistency, i.e. a situation where a group of contentions seem individually plausible but are collectively incompatible.

The root idea of aporetics – the theory of rational deliberation in the face of inconsistencies – "lies in the combination of reductive control in situations where we have succumbed to the cognitive overcommitment of inconsistency and find ourselves having to salvage some part of what must be abandoned".

According to Rescher, the tendency to hypertrophy that arises from the conjunction of conflicting propositions can only be countered by a plausibility analysis, a process that enables the "chain of inconsistency" to be broken by abandoning one or more of the contentions (the weakest links) that cannot be maintained together.

Rescher, N., Aporetics: Rational Deliberation in the Face of Inconsistency. 2009, Pittsburgh, PA: University of Pittsburgh Press.

HOW PLAUSIBLE IS THE IDEA OF A ROBUST GOVERNANCE STRUCTURE FOR GEOENGINEERING?

The most intense and stormy controversies in geoengineering are more about the question of political control over the development and deployment of its associated technologies, as well as about underlying moral uncertainties, than about scientific and technical issues.

Whose hand is on the thermostat?
Cartoon by Catherine Pain

This image has the power of reminding us that recent proposals to geoengineer the climate are just one contemporary manifestation of man's long-standing desire to control nature - an early-twenty-first-century embodiment of the Baconian project of human mastery over nature.

Whose hand is on the thermostat?

This hand is a legitimate hand; a hand that represents our capacity to overcome the current political inertia on climate change - the weak political leadership, the power of the fossil fuel lobby, the pervasive wishful thinking and the culture of denial that have undermined Plan A - and that after an obstinate resistance, we were able to establish legitimate geoengineering institutions that invoke the appropriate norms of justice and community.

This hand is an illegitimate hand; a hand that not only failed to address the problem of political inertia, but by trying to operate with its constrains, was able to license illegitimate geoengineering activities, violating the kinds of norms of global justice and community that dealing with the problem of climate change might suggest.

FINAL REMARKS

The considerations of reasonability and plausibility that lie at the heart of the geoengineering narratives should be understood as manifestations of a reasoning process in-between two theoretical traditions:
i) the instrumental technical rationality of modern conceptions of scientific reasoning and
ii) the tradition of practical reasoning that draws on practical value rationality to challenge the logical empiricism, its ontological privileging of scientific knowledge, and the adequacy of "instrumental rationality alone".

There are at least three different areas where the scientific method itself depends heavily on plausible reasoning:

(1) the formulation of hypothesis to be tested,

(2) the devising of experiments to test them, and

(3) the selection of which unrefuted hypothesis should be provisionally accepted (because although experiments can refute general assertions about the world, they cannot give them positive support without the aid of plausible reasoning).

Plausibility tends to play a prominent role in the entanglements of imaging and imagining of geoengineering

These are entanglements of the present and the future, of the world in which we live and of worlds that might be realized; of a science that has to deal with our incomplete, inconsistent, and uncertain knowledge and a science that aspires to precision and exactitude; of a humanity constrained by its very nature and a humanity that aspires to transcend its own nature.

Rescher's Fundamental Rule of Presumption

"Presumption favors the most plausible of rival alternatives – when indeed there is one. This alternative will always stand until set aside (by the entry of another, yet more plausible, presumption"

Plausibility as the fundamental instrument of epistemic prudence, closely analogous to the prudential principle of action

Altonaer Stiftung für philosophische Grundlagenforschung

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Imag[in]ing Geoengineering - The Plausible and the Implausible