Geoengineering Our Climate?

Ethics, Politics and Governance

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Framing Geoengineering Assessment

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The ways in which social actors choose to organise and communicate, or 'frame', ideas such as geoengineering channel expressions of power. In support of decision making, the selection of contexts and methods in technology assessment both constitute broad sites of instrumental framing, which act to condition assessment outcomes.[1] As an 'upstream'[2] suite of technology proposals that is currently in advance of significant research and development or public controversy, geoengineering is particularly sensitive to these, and other, framings.

Assessments of geoengineering have so far largely taken place under two dominant problem definitions.[3] First, that efforts to reduce greenhouse gas emissions will not be enough to tackle climate change ('insufficient mitigation'). Second, that as a result of this, we may be faced with a dangerous change in climate, often stylised as crossing one or more 'tipping points' (a 'climate emergency'). Both of these framings posit a central role for geoengineering in tackling climate change, concurrently marginalising legitimate alternatives. Accordingly, geoengineering assessments have largely excluded mitigation options and adaptation, placing the proposals in what can be termed 'contextual isolation'.

Although geoengineering framings have begun to emerge and diversify in the media[4] (with coverage likely to increase following its heightened prominence within the Fifth Assessment Report of the Intergovernmental Panel on Climate Change), it typically remains a scientifically and technically framed issue within the assessment literature.[5] Most of the assessments use technical and analytic methods that are exclusive to experts (such as climate models or cost-benefit analysis), and narrowly-focused, technical criteria (such as global temperature reduction, rapidity of effect and cost). Under such methods and criteria certain issues are privileged, and so too are certain proposals. It is perhaps no surprise then that an ostensibly effective, fast-acting and cheap proposal, stratospheric aerosol injection, often performs very highly[6] and is gaining attention.

The expert multi-criteria assessment conducted for the Royal Society's (2009) seminal report provides a valuable illustration of how framing geoengineering assessment through the selection and elevation of particular criteria can compel particular outcomes. The assessment utilised four technical criteria with which to evaluate the proposals: effectiveness, affordability, timeliness and safety. In then presenting the performances of the different proposals on a two axis figure, a difficult decision was made with respect to which of the four criteria would be given priority on those axes. It was decided that effectiveness and affordability would be given that normative priority, and under that configuration stratospheric aerosol injection performed the highest overall.

The prioritisation of effectiveness and affordability on those axes, however, was only one of a possible six permutations (Figure 1). Each of the differently framed permutations offers a distinct pattern of performances, where different overall conclusions can be

[1] Stirling, 2008
[2] Wilsdon and Willis, 2004
[3] Bellamy et al, 2012
[4] Porter and Hulme, 2013; Scholte et al, 2013
[5] Bellamy et al, 2012
[6] Lenton and Vaughan, 2009; Royal Society, 2009; Bickel and Lane, 2009

drawn. Where the original configuration places stratospheric aerosol injection most highly (a), that performance is accentuated even further under effectiveness and timeliness criteria (b), owing to its perceived capacity for pre-emptive or responsive action in facing a sudden 'climate emergency'. Where safety is prioritised alongside effectiveness a somewhat different picture emerges (c), with air capture and storage performing the highest overall. Under affordability and timeliness criteria, stratospheric aerosol injection returns to a high performance, but alongside the somewhat more benign afforestation (d). Afforestation retains the coveted position of highest overall performance under affordability and safety, and timeliness and safety criteria (e, f).

These permutations demonstrate how different instrumental framings can serve to 'close down' on certain geoengineering proposals.[7] Such closure leads to prescriptive policy recommendations that promote further research and investment in proposals that seem preferable given the narrow framings upon which they are built. This poses the risk of premature 'lock-in'[8] to particular future pathways that could instigate conflict and controversy between divergent values and interests. Geoengineering assessments should instead seek to 'open up' option and policy choice by adopting broader and more diverse framings in order to guard against this lock-in.[9] Rather than providing prescriptive policy recommendations, the assessments would provide conditional recommendations that expose the framing conditions under which options perform.

[7] Stirling, 2008; Bellamy et al, 2012
[8] Arthur, 1989
[9] Stirling, 2008

The primarily narrow and technical problem definitions and criteria deployed in geoengineering assessments have recently prompted the use of a different kind of expert-analytic method; one that seeks to open up those, and other, inputs. Using a Multi-Criteria Mapping methodology[10] and in defining the 'problem' as one of responding to climate change in its broadest sense, rather than in narrowly responding to insufficient mitigation or a climate emergency, a diversity of alternative options and criteria has been yielded.[11] Both the range and depth of criteria has been diversified, under which a radically different picture of option performance emerges. The range of criteria groups has been opened up beyond 'technical' issues to include those of 'social' ones spanning politics, society, ethics and co-benefits to show that geoengineering proposals, and stratospheric aerosol injection more acutely, are outperformed by mitigation alternatives. Moreover, the depth of criteria groups has been opened up within those 'social' issues as well as the more 'technical' issues of efficacy, environment, feasibility and economics, to show the same pattern.

In seeking to open up the assessment of geoengineering further still, a small but significant literature in public participation has begun to emerge. The outcomes from participatory assessments (such as surveys or focus groups), however, are also susceptible to instrumental framing. The 'climate emergency' framing has proven particularly potent in such settings, underpinning apparent public support for research into solar geoengineering in a cross-cultural survey[12], and likely improving the perceived public acceptability of

[10] Stirling and Mayer, 2001
[11] Bellamy et al, 2013
[12] Mercer et al, 2011

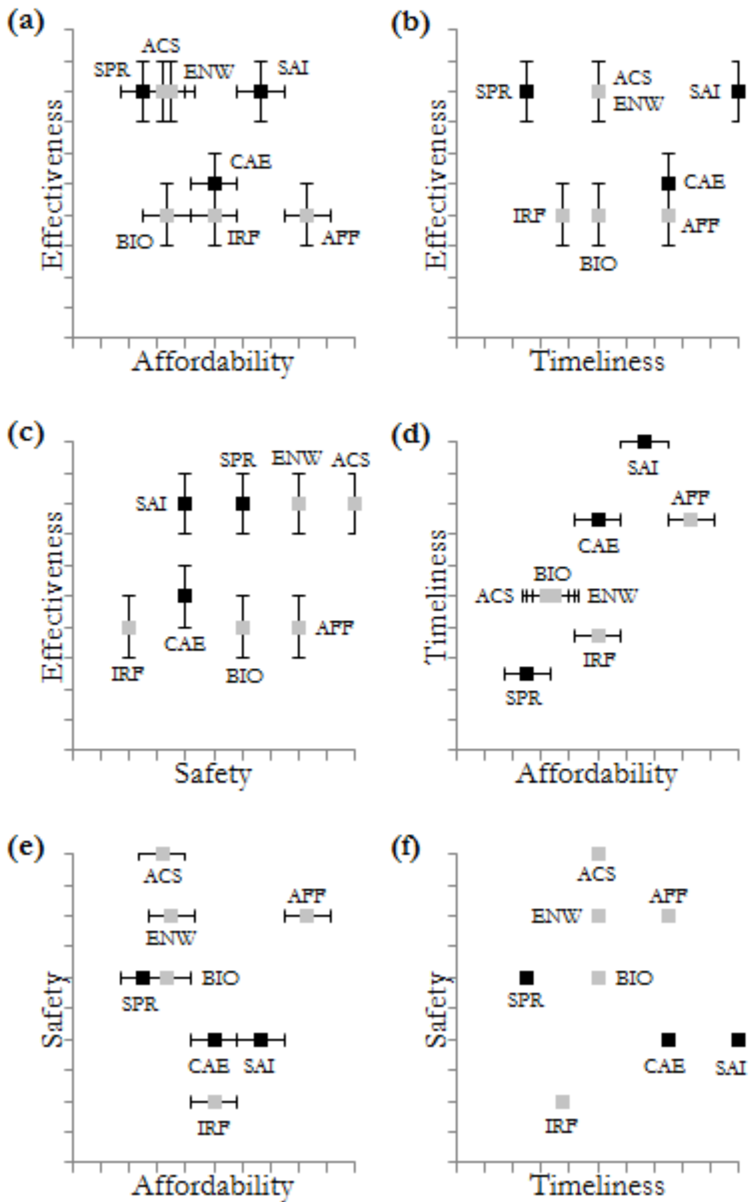
solar geoengineering in the UK-based Experiment Earth? public dialogue. A 'naturalness' framing was also likely to have improved the perceived acceptability of particular geoengineering proposals in that same public dialogue.[13] Framing air capture and storage as 'artificial trees' and stratospheric aerosol injection as 'no different to a volcano', for example, might constitute valid technical descriptions, but can also frame particular ends. Nevertheless, the naturalness framing has also emerged unprompted from publics themselves as an important element in forming their perceptions of geoengineering.[14]

Broadening out and opening up geoengineering assessment reveals the complexities and uncertainties that are often reduced and hidden in narrowly framed assessments. For policy makers, this might make uneasy reading. Opening up assessment in these ways may appear to make decision making harder rather than easier. However, this need not be the case. Neither expert-analytic nor participatory assessment methods are complete without the other, and so methods have been designed that integrate both elements. Deliberative Mapping is one such method that we have recently developed and used[15], in combination with Multi-Criteria Mapping[16], to evaluate geoengineering proposals alongside other options for tackling climate change. Whilst the method seeks to map divergence of perspectives, it can equally map consistencies. Indeed, a remarkable level of consistency has been found across expert, stakeholder and public perspectives, with geoengineering proposals being outperformed by mitigation alternatives.

We can draw a number of lessons for future research and policy from attempts at framing geoengineering assessment. Firstly, the contextual isolation into which geoengineering has been placed must be overcome, by replacing narrow problem definitions such as being faced with a 'climate emergency', with broader ones such as 'responding to climate change'. This introduces alternative options spanning mitigation and adaptation that cannot be ignored. Secondly, the use of narrow, technical criteria must overcome by expanding the range and depth of 'social' as well as 'technical' criteria. This second lesson must be supported by a third, in which the prevailing use of expert-analytic methods of assessment must be supplemented by, or integrated with, (carefully-framed) participatory methods that include a diversity of stakeholders and publics. This diversity will help hedge against the risk of 'lock-in' to particular proposals that may at first appear preferable under certain framings. Taken together, these lessons argue that the framing of geoengineering assessments should be broadened out and opened up.[17] Indeed, as this article has shown, some initial efforts have already been made in acting on these lessons but much more remains to be done.

[13] NERC, 2010; Corner et al, 2011
[14] Corner et al, 2013
[15] Bellamy et al, under review
[16] Bellamy et al, 2013
[17] Stirling, 2008; Bellamy et al, 2012

Figure 1.
Permutations in a multi-criteria assessment of geoengineering proposals.



Acronyms: afforestation (AFF); air capture and storage (ACS); biochar (BIO); cloud albedo enhancement (CAE); enhanced weathering (ENW); iron fertilisation (IRF); stratospheric aerosol injection (SAI); space reflectors (SPR). Proposals coloured grey and black represent carbon geoengineering and solar geoengineering proposals respectively. This figure was produced using the original performance scores and margins of error for select proposals provided in the Royal Society (2009).

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