

Ethical Anxieties

Justifying geo-research

At its core, climate engineering is a moral question. The same is true of all major environmental disputes – over nuclear power, genetically modified organisms and lead pollution. Each controversy has been driven by ethical arguments. In the case of geoengineering the moral landscape is only just beginning to be recognized.

In his 2006 intervention Paul Crutzen wrote: ‘By far the preferred way to resolve the policy makers’ dilemma is to lower the emissions of the greenhouse gases. However, so far, attempts in that direction have been grossly unsuccessful.’¹ The starting point for any consideration of the ethics of geoengineering is this failure of the world community to respond to the scientific warnings about the dangers of global warming by cutting greenhouse gas emissions. When I say it is a failure of the ‘world community’ this should not obscure the fact that it has been certain powerful nations, and certain powerful groups within those nations, that have been responsible for this failure.² As we will see, not all those promoting geoengineering research and deployment view it as a response to moral failure, so it helps to set out briefly the

arguments in favour of research into geoengineering. I will refer mainly to the case of sulphate aerosol injections because it illustrates the ethical anxieties most starkly. Some of the arguments apply equally to the other system-altering technologies, notably ocean iron fertilization and marine cloud brightening, but may have less force when applied to more localized interventions.

Three main justifications are used to defend research into geoengineering and possible deployment: it will allow us to buy time, it will allow us to respond to a climate emergency and it may be the best option economically.

The *buying-time argument* – the main one used in favour of more research in the 2009 Royal Society report³ – is based on an understanding of the failure to cut global emissions as arising either from political paralysis or from the power of vested interests. The logjam can only be broken by the development of a substantially cheaper alternative to fossil energy because countries will then adopt the new technologies for self-interested reasons. Sulphate aerosol spraying would allow warming to be controlled while this process unfolds. It is therefore a *necessary evil* deployed to head off a greater evil, the damage due to unchecked global warming. It is a powerful, pragmatic ethical argument for research into geoengineering and its possible deployment.

The *climate emergency argument* was Crutzen’s motive for breaking the silence over geoengineering. Sulphate aerosol injection, he wrote, should only be developed ‘to create a possibility to combat potentially drastic climate heating.’⁴ Today it is an argument growing in influence, reflecting concern about climate tipping points.⁵ It envisages rapid deployment of a solar filter in response to some actual or imminent abrupt change in world climate that cannot be averted even by the most determined mitigation effort. It’s easy to see how, in some circumstances, this argument could be

an overwhelming one. Although the solar shield may have drawbacks, failing to deploy it could result in much greater harm.

As in the case of buying time, the *best-option argument* would see sulphate aerosol spraying deployed pre-emptively rather than being left 'on the shelf' until an emergency occurs. Rejecting the understanding of geoengineering as an inferior response, it argues that there is nothing inherently good or bad in any approach to global warming. The decision rests on a comprehensive assessment of the consequences of each approach, which is often reduced to the economist's assessment of costs and benefits. In this narrow consequentialist or utilitarian approach the 'ethical' decision is the one that maximizes the ratio of benefits to costs. As we saw in chapter 5, some early economic modelling exercises have concluded that geoengineering is cheaper than mitigation and almost as effective and is therefore to be preferred.

Those economists who adopt the best-option argument see geoengineering as a potential substitute for mitigation rather than as a complement to it. They do not accept that geoengineering represents a necessary evil. If Plan B proves to be cheaper than Plan A then it would be unethical *not* to use it. They thereby avoid accusations that their advocacy undermines the incentive to choose the better path; geoengineering *is* the better path.

Philosophically, this requires the adoption of a narrow utilitarian moral viewpoint. Using this framework it is possible to maintain that geoengineering is (or could be) a good thing only when all of the positive and negative effects of all plans are commensurable, so that one can be traded off against another. More precisely, for the utilitarian they can be traded off without feelings of guilt, regret or anguish.⁶ We all at times have to make forced choices; but what makes some choices forced is that the decision entails a moral struggle. For the utilitarian no choices are

forced because all effects can be traded off on rational grounds. Utilitarianism is the emotionless philosophy.

One implication of the narrow consequentialist approach is that there is nothing inherently preferable about the natural state, including the current climate. Depending on the assessment of human well-being, there may be a 'better' temperature or climate as a whole. In other words, it is ethically justified for humans to 'set the global thermostat' in their interests, if they can agree on what their interests are.

Another uncomfortable implication of the best-option argument is that it implies that the ethics of geoengineering actually excludes values because the argument can be reduced to apparently objective scientific and economic facts. So the utilitarian position rejects the view, implicit in the other two arguments, that motives count when making ethical judgements. The economists and utilitarian philosophers who adopt this approach see themselves as pragmatic – what matters, practically and ethically, is what works. Most people believe that intentions matter morally, which is why courts judge manslaughter less severely than murder. Against this everyday intuition, some philosophers argue that there is no defensible distinction between a harm caused intentionally and the same harm caused unintentionally, that the degree of 'wrongness' of an action has no bearing on its degree of 'badness'.⁷

The issue is complicated by the fact that, since we know that continuing to burn fossil fuels will cause harm, it could be said that global warming is now 'deliberate' even if warming is not the intention. Continued release of greenhouse gases is unquestionably negligent, but I think there is a moral, and certainly an attitudinal, leap to a conscious plan to modify the Earth's atmosphere. This is why studies concluding that sulphate aerosol spraying could disrupt the Indian monsoon are potentially explosive.⁸ Certainly,

one would expect the law to take the view that damage to someone arising from a deliberate action carries more culpability. In law, culpability for harms caused by an action depends in part on *mens rea*, literally 'guilty mind'.

Moral corruption

The psychological strategies we deploy to deny or, more commonly, to evade the facts of climate science, and thereby to blind ourselves to our moral responsibilities or reduce the pressure to act on them, were described in chapter 4. They include wishful thinking, blame-shifting and selective disengagement. For selfish reasons we do not want to change our behaviour or be required to do so by electing a government committed to deep cuts in emissions. Stephen Gardiner argues that this kind of situation gives rise to moral corruption, 'the subversion of our moral discourse to our own ends.'⁹ Unlike the moral hazard and slippery slope arguments (considered in the next sections), moral corruption is not concerned with the consequences of our actions but with notions of 'bad faith', that is, duplicity and self-deception.

Climate engineering may lend itself to moral corruption. If we are preparing to pursue geoengineering for self-interested reasons – because we are unwilling to restructure our economies or adjust our lifestyles – then the promotion of geoengineering can provide us with a kind of cover or even self-absolution. But if climate engineering is inferior to cutting emissions (in the sense of being less effective and more risky) then merely by choosing to engineer the climate instead of cutting emissions we succumb to moral failure. It should be remembered that consideration of climate engineering comes after a long history of bad faith in international negotiations, in which various nations have engaged in pious declarations of

concern coupled with ruthless obstructionism. Even when agreement has been reached, as in Kyoto in 1997, some nations have reneged on their commitments.

This picture of moral failure and bad faith cannot now be wiped away using some kind of historical Etch A Sketch, because climate engineering is a direct result of that failure. If we resort to climate engineering then the efforts of ExxonMobil, for example, to subvert the truth would be rewarded. More generally, those most negligent in carrying out their duties would be able to use geoengineering to avoid censure. Installing a solar filter would cement the failure of the North in its obligations to the global South. This is another way of making the case that what matters ethically about geoengineering is not only the outcome but also the human virtues or faults it reveals. In the end it might be judged that rewarding those guilty of bad faith is an unfortunate necessity.

Accusations of 'copping out' may not apply to those who are constrained in their actions, so that implementing the best plan is beyond their power. This is sometimes called the 'control condition' for moral responsibility.¹⁰ It presents a moral dilemma for environmental groups: if they believe that Plan B is inferior to Plan A, then supporting geoengineering can be justified only if they believe they can no longer effectively advance Plan A. The dilemma deepens if it proves that supporting geoengineering actually makes emission reductions less likely to be pursued. Most environmental groups have adopted a wait-and-see approach, although they are instinctively suspicious of climate engineering.¹¹

Scientists who defend geoengineering research are mostly exempt from the moral failings that have given rise to the situation. After all, most are among those who have supported strong abatement action and have become alarmed and frustrated at the failure of political leaders to act. It's not their fault and, deeply concerned,

they are looking for ways of saving the world from the consequences of institutional failure. For both environmentalists and researchers who see geoengineering as a necessary evil, to maintain their integrity they must continue to argue that mitigation is superior. So, like Crutzen, the 2009 Royal Society report declared resolutely that mitigation is to be strongly preferred and geoengineering cannot be 'an easy or readily acceptable' alternative.¹²

Nevertheless, simply restating this belief may not be enough; unless one continues to act on it, the declaration risks becoming merely a means of deflecting censure. This draws attention to the position of governments and major fossil fuel corporations – for it would be hollow for them to argue that they are pursuing Plan B even though they believe Plan A is superior. They have the power to implement Plan A, or not to block it, and their reluctance or obstructiveness is the reason Plan B is being considered in the first place. To promote geoengineering they must convince others that it is not in their power to reduce emissions, a tactic that is frequently used. Even in the United States some argue that there is no point in cutting US emissions if other major emitters do not do the same, an appeal to the 'prisoner's dilemma' that all too easily serves as an excuse for inaction.

Recourse to the prisoner's dilemma – a situation in which it is in the collective interest to cooperate but, in the absence of trust, in the individual interest to behave selfishly and penalize others – is often an attempt to 'rationalize' moral decisions, that is, to shift surreptitiously to a consequentialist framing in which calculating outcomes gives the moral answer. Ethics becomes a 'game' that abolishes the motivation to do the right thing. So the prisoner's dilemma is often not a bona fide reason for lack of progress, but the opposite, a cover for bad faith. 'Hey, we want to do the right thing, but if others will not cooperate, what can we do?'

Moral corruption is a danger to geoengineering researchers tempted to accept financial support from governments, or fossil fuel corporations seeking to avoid their obligations. In 1962, noting the amount of money poured into universities by chemical companies, Rachel Carson observed: 'This situation ... explains the otherwise mystifying fact that certain outstanding entomologists are among the leading advocates of chemical control. Inquiry into the background of some of these men reveals that their entire research programme is supported by the chemical industry.'¹³ Bad faith stains those who get too close. It's worth noting that when the time arrives at which they feel they can back research into climate engineering, governments and fossil fuel corporations are unlikely to appeal to the climate-emergency justification because highlighting the severity of global warming would only underline their moral failure. Moreover, as we saw, those able to implement emission cuts will lack credibility if they defend climate engineering with the buying-time argument. This leaves them with the best-option economic argument. In the case of the solar shield, the empirical basis remains speculative, not least because the risks of unintended consequences appear so high. Moreover, the appeal to economics as the basis for making such a momentous decision risks accusations of abandoning ethical concerns and treating the atmosphere as a resource.

The same moral failure arguments could be used by poor countries against rich ones. As it will probably be industrialized nations, including China, that invest most in geoengineering research and, if the time comes, deployment of the technologies that result, poor countries will accuse them of evading their obligations to reduce emissions. Studies indicating that some poor countries may suffer harms from some climate engineering techniques reinforce the likely sense of grievance. The ethical situation would be reversed if

a small, poor and vulnerable country decided to protect itself by engineering the climate with sulphate aerosol spraying (something that may prove technically and financially feasible). The Maldives, for example, would have a strong moral case to argue that the threat to its citizens' survival from rising seas caused by the refusal of major emitting nations to change their ways, and its own inability to influence global warming despite sustained efforts, leave it with no choice.

Moral hazard

It is widely accepted that having more information is uniformly a good thing as it allows better decisions to be made. Geoengineering research is strongly defended on these grounds. Yet for many years research into geoengineering, and even public discussion of it, was frowned on by almost all climate scientists. As we saw, when Paul Crutzen made his famous intervention in 2006 calling for serious study of sulphate aerosol spraying he was heavily criticized by fellow scientists. They felt that investigating climate engineering would erode the incentive to reduce emissions, the response to global warming strongly preferred by scientists, including Crutzen himself.

In other words, they were worried about 'moral hazard', a concept developed by economists to capture the impact on incentives of being covered against losses. For example, it is argued that the incentive to drive a car carefully may be reduced if the driver is insured because the costs of an accident are spread across all who are insured. Although commonly used in the climate change context, the argument mistakenly transposes an understanding of incentives developed for private market behaviour into the realm of public policy decision-making. There are a number of ethical

and practical objections to this move,¹⁴ perhaps illustrated most starkly by the unwitting *reductio ad absurdum* embedded in the claim by economist Martin Weitzman that assessing the worth of 'life on Earth as we know it' is 'conceptually analogous' to deciding, for example, how much to pay for additional airbags in a car. Life on Earth itself is converted into a financial value by reducing it to how much we'd be willing to pay in the market.¹⁵

Nevertheless, the idea of moral hazard, suitably modified, is useful for drawing attention to political incentives. The availability of an inferior policy substitute that can be made to appear superior may make it easier for a government to act against the national interest.¹⁶ It is well established that those whose financial interests would be damaged by abatement policies have been using their power in the political system to slow or prevent action.¹⁷

So does geoengineering research create moral hazard? Geoengineering researchers tend to be vague and somewhat dismissive of the likelihood, as though it is only of theoretical concern. The 2009 Royal Society report, dominated by geoengineering researchers, treats it as an uncertain effect that may even work the other way, and refers to some distinctly unpersuasive focus group work suggesting that individuals might increase their efforts to cut their emissions if government invested in geoengineering.¹⁸ Overall, the report saw moral hazard (wrongly interpreted as concerning individual behaviour) as a 'factor to be taken into account', but in no way decisive.

Yet in practice any realistic assessment of how the world works must conclude that geoengineering research is virtually certain to reduce incentives to pursue emission reductions. This is apparent even now, before any substantial publicly funded research programmes have begun. Already a powerful predilection for finding excuses not to cut greenhouse gas emissions is obvious to

all, so that any apparently plausible method of getting a party off the hook is likely to be seized upon. For the moment, governments and energy companies are staying at arm's length from geoengineering research, precisely because they fear being accused of wanting to evade their responsibilities. But the day when it becomes respectable to support geoengineering research cannot be far off. Already, representatives of the fossil fuel industry have begun to talk of geoengineering as a *substitute* for carbon abatement.¹⁹ Economic analysis is in general not interested in the kind of judicious technology mix or emergency back-up defended by some scientists, but will readily conclude that geoengineering should be pursued, even as the sole solution, if that's what the cost curves show. Indeed, the popular but error-riddled book *Superfreakonomics* insists that the prospect of solar radiation management renders mitigation unnecessary: 'For anyone who loves cheap and simple solutions, things don't get much better.'²⁰ Instrumental thinking does not come much cruder, yet it is just this kind of Promethean wand-waving that prevails in the power centres of the world. For the authors, economics renders ethical concerns redundant: 'So once you eliminate the moralism and the angst, the task of reversing global warming boils down to a straightforward engineering problem: how to get thirty-four gallons per minute of sulfur dioxide into the stratosphere?'

We have seen that conservative think tanks are joining the fray, with the climate-denying Heartland Institute and American Enterprise Institute supporting climate engineering. Former Republican presidential candidate and House Speaker Newt Gingrich declared: 'Geoengineering holds forth the promise of addressing global warming concerns for just a few billion dollars a year. Instead of penalizing ordinary Americans, we would have an option to address global warming by rewarding scientific invention ... Bring on the American ingenuity. Stop the green pig.'²¹ For

these advocates the problem of moral hazard evaporates because there is nothing wrong with eroding the incentive to cut carbon emissions if a cheaper means of responding to global warming is available.

Gardiner has offered a left-field argument for the irrelevance of concerns about moral hazard.²² After the Copenhagen fiasco, the prospects for substantial emissions abatement policies in the foreseeable future sank so low that the availability of a substitute to abatement could not drive them any lower. It is an argument from despair. Against it, in some parts of the world – notably the European Union and China – substantial efforts are being made to reduce emissions and accelerate the development of alternative energy technologies. In 2011 parliamentary support for the Australian government's carbon tax was on a knife-edge. Inadequate as they are, these efforts depend on a level of political resolve that could be weakened. Moreover, incentives to act could change rapidly as the effects of climate change become more obvious over the next decade and the availability of an apparently effective alternative to emission cuts could determine the kind of action taken.

That in practice moral hazard is the most powerful ethical argument against the development of geoengineering technologies is suggested by the highly germane case of carbon capture and storage (CCS).²³ Soon after the 1997 Kyoto agreement, the governments of the two nations that refused to ratify it, the United States and Australia, began talking up the benefits of CCS, a technology that promised to extract carbon dioxide from the smokestacks of coal-fired power plants, pipe it to suitable geological formations and bury it permanently deep beneath the earth. Burning coal would be rendered safe so there was no need to invite 'economic ruin' with policies mandating emission reductions. Quickly branded 'clean coal', the promise of the technology was increasingly relied on by

the world coal industry to weaken policy commitments and spruce up its image.²⁴ The promise of CCS has been used repeatedly by both governments and industry as a justification for building new coal-fired power plants. In the United Kingdom, Prime Minister Gordon Brown declared that we must have it 'if we are to have any chance of meeting our global goals.'²⁵ US President Barack Obama's public endorsement of 'clean coal' was featured in PR videos made by the coal lobby.²⁶ German Chancellor Angela Merkel backed industry plans to build dozens of new coal-fired power plants, expecting that at some point they would be able to capture the carbon dioxide and send it to subterranean burial sites.²⁷ In Australia, the world's biggest coal exporter and the nation most dependent on coal for electricity, Prime Minister Kevin Rudd declared CCS 'critical' to generating jobs and bringing down greenhouse gas emissions.²⁸

Economists also bet on the technological promise. The Stern report called CCS 'crucial.'²⁹ Jeffrey Sachs, Director of the Earth Institute, repeated the common opinion that there is no way China will stop building coal-fired power plants, so the technology 'had better work or we're in such a big mess we're not going to get out of it.'³⁰ The Garnaut report wrote that the success of 'clean coal' will ensure that any negative impacts of greenhouse policies on coal-dependent regions are 'many years away.'³¹ The International Energy Agency promoted it enthusiastically, describing an ambitious roadmap for the deployment of the technology, to be led over the next decade by developed countries, after which 'CCS technology must also spread rapidly to the developing world', because without it costs of emissions reductions will be 70 per cent higher.³²

Torrents of public funding flowed to CCS research. The Obama Administration's 2009 stimulus bill allocated US\$3.4 billion and the US Department of Energy announced it would

provide US\$2.4 billion to 'expand and accelerate the commercial deployment of carbon capture and storage technology.'³³ In the same month, the Rudd government in Australia announced it would commit A\$2.4 billion (around US\$2 billion at the time) to an industrial-scale demonstration project.³⁴ In 2009 the high hopes invested in CCS provoked the conservative business magazine *The Economist* to comment that 'the idea that clean coal . . . will save the world from global warming has become something of an article of faith among policymakers.'³⁵

Yet from the outset impartial experts argued that the promise of CCS was exaggerated.³⁶ Even supporters of CCS conceded that the technology, if it worked, would have no impact on global emissions until at least the 2030s, well after the time scientists say deep emission cuts must begin. The most damning assessment was made in 2009 by *The Economist* in an editorial titled 'The illusion of clean coal':

The world's leaders are counting on a fix for climate change that is at best uncertain and at worst unworkable. . . . CCS is not just a potential waste of money. It might also create a false sense of security about climate change, while depriving potentially cheaper methods of cutting emissions of cash and attention – all for the sake of placating the coal lobby.³⁷

The Economist was echoing the warnings of critics who, from the outset, identified one of the major risks associated with pursuit of CCS as the way in which it would undermine global mitigation efforts by giving national governments an excuse to do nothing in the hope that coal plants could be rendered safe.

It turns out that the critics were right. Despite the hype, the hopes and the public investment, the promise of CCS is now

collapsing. Its leading experts are expressing disappointment at the failure of governments and the coal industry to follow through on their commitments.³⁸ In November 2010 Shell's Barendrecht carbon capture project in the Netherlands was cancelled due to local opposition.³⁹ A month later ZeroGen, a huge project identified by the Australian government as a 'flagship' carbon capture project, was shelved because of cost blow-outs and technical difficulties.⁴⁰ The *New York Times* commented: 'Australia's experience with CCS mirrors technical, financial and political hurdles experienced in the United States.'⁴¹

There could not be a more vivid illustration of moral hazard than CCS, yet it is into this political and commercial environment that geoengineering arrives as the next great white hope. It is presented as a solution to the same global warming problem, to the same politicians, with the same recalcitrant industry, the same public prone to wishful thinking and the same largely uncritical media. The conditions are perfect for moral hazard.

The false promise of CCS played a vital role in the lost decade of response to climate change. Will geoengineering be the excuse for another lost decade? There is no sign that political leaders have been chastened by the sorry experience of CCS. If they are resolved to avoid difficult decisions and cosset the coal industry, why would they not just move on to the next technological boondoggle? Once the political threshold that currently restrains governments and coal companies from publicly backing geoengineering is crossed, warnings such as that made by the Royal Society – 'None of the methods evaluated in this study offer an immediate solution to the problem of climate change and it is unclear which, if any, may ever pass the tests required for potential deployment'⁴² – are likely to be swamped by bold claims. The caveats at the front of geoengineering reports declaring that mitigation is the best solution will

quietly disappear. Climate engineering has 'moral hazard' written all over it.

Lure of the technofix

If Plan B is inferior to Plan A the moral hazard is that its political attractions will undermine the incentive to cut emissions. So engineering the climate is deemed preferable despite the evidence. The slippery slope is an ethical concern closely related to moral hazard; moral hazard applies to policy-makers, while the slippery slope applies to those who back geoengineering. A lobby group of researchers, investors and, perhaps, regulators backing geoengineering is naturally inclined to overstate its benefits and understate its costs, and its risks. In 1962 Rachel Carson wrote: 'The chemical weed killers are a bright new toy. They work in a spectacular way; they give a giddy sense of power over nature to those who wield them, and as for the long-range and less obvious effects – these are easily brushed aside as the baseless imaginings of pessimists.'⁴³

As we saw in chapter 4, the constituency for geoengineering is growing, and already reaches into stratospheric levels of wealth and power. Several influential inquiries have called for research programmes; it is being talked about in the White House; parliaments are interested; military planners are becoming engaged; venture capitalists and billionaires are investing; and patents are being registered. The conditions are ideal; we are already sliding down the slippery slope and it is only a matter of time before policy-makers come under intense pressure to choose the less desirable options. There is therefore a legitimate concern that the knowledge generated by geoengineering research will be misused in foreseeable ways.

However, the strength of the moral hazard and the slippery slope dangers depend in part on the absence of technological hurdles that appear insurmountable. While the experience with carbon capture and storage points to the strength of the moral hazard concern about geoengineering, it also suggests a brake on the slippery slope. A very powerful constituency formed around the promise of CCS, perhaps reaching its pinnacle with the creation in 2009 of the Global Carbon Capture and Storage Institute.⁴⁴ 'Clean coal' is not dead yet but, as the technical difficulties become more apparent, it is waning as a credible alternative to emission reductions, and the momentum is stalling. Yet a decade was lost. The slippery slope towards the deployment of, say, sulphate aerosol spraying will depend on continued research and testing not turning up some severe risk or insuperable obstacle that its more open-minded supporters cannot ignore. On the other hand, as the severity of global warming manifests, the penchant for downplaying the risks will intensify.

On the slippery slope, technologies gather added political momentum because we live in societies predisposed to seek technological answers to social problems. Previously, I have attributed our failure to cut emissions to political systems influenced by sectional interests, dominated by growth fetishism and led by individuals too timid to act on the scientific warnings. I have also attempted to explain widespread denial and evasion in terms of the comfortable conservatism of consumer society and the gradual alienation from nature.⁴⁵ Among conservatives there is a tendency to regard these as immutable facts of modern life. So instead of promoting change in political and social structures we are urged to resort to technological solutions that will bypass the blockages. Advocating far-reaching social change is dismissed as 'utopian'. But is social change in response to climate change impossible? Debating

radical social change was part of the daily discourse of Western society from the time of the French Revolution until the 1980s, when the neoliberal revolution brought about 'the end of history', so the unwillingness today to consider changes to economic, social and political structures is all the more striking in the face of a threat as grave as the climate crisis. Shunning deeper questioning of the roots of the climate crisis avoids uncomfortable conclusions about social dysfunction and the need to challenge powerful interests. Calls for a technofix, including geoengineering, are thus deeply conformable with existing structures of power and a society based on continued consumerism. The slippery slope to the technofix promises a substitute for the slippery slope to 'revolution'.

An extreme kind of technofix as a response to global warming has recently been put forward by three philosophers (of the Anglo-American school) in a bizarre paper titled 'Human engineering and climate change'.⁴⁶ The authors, Liao, Sandberg and Roache, argue that we should consider seriously proposals to 'engineer' humans to reduce carbon emissions. One leading idea is genetic intervention to allow parents to select shorter children because smaller people eat less. They also use less petrol in their cars, need less energy-consuming fabric for their clothes, and wear out their shoes more slowly. If families had a cap on their emissions, parents could choose 'between two medium-sized children, or three small-sized children' or, if they wanted a basketball player, 'one really large child',⁴⁷ although an unintended consequence of using hormone treatment to create smaller children is a greater risk of gallstones.

Their other proposals for human engineering include genetically engineering human eyes to be more like those of a cat because 'if everyone had cat eyes, you wouldn't need so much lighting'; reducing the birth rate by 'cognitively enhancing' unintelligent

women because 'women with low cognitive ability are more likely to have children before age 18'; 'pharmacological enhancement of altruism and empathy'; and pills that make those who take them vomit if they eat beef, thereby reducing demand for beef.

The paper, published in a respectable journal, is beyond satire and its only likely effect is to bring the philosophy profession into disrepute. Analytical philosophy, it seems, does not have a 'laugh test' for filtering out whacky proposals. If we are to engineer humans to have cat's eyes and midget babies, why not genetically modify black people to make them white in order to cool the Earth by increasing its reflectivity?

Defending his decision to publish, the editor of the journal claims the authors are engaged in a 'Swiftian philosophical thought experiment'.⁴⁸ In fact, the opposite is true. Jonathan Swift's 'modest proposal' that poverty-stricken Irish peasants support themselves by selling their babies to be eaten by the rich – 'a young healthy child well nursed is at a year old a most delicious, nourishing, and wholesome food, whether stewed, roasted, baked, or boiled' – was a savage satire on the heartlessness of society in the face of mass suffering. The three philosophers are not lampooning our disregard of the threat of climate change. It is as if Swift had put forward his modest proposal as a legitimate response to famine. No doubt it could be wholly justified in utilitarian terms; indeed Swift himself carried out the cost-benefit analysis in order to heighten the ridicule.

The three bio-ethicists suggest that people who are appalled at the idea of human engineering may have a 'status quo bias', resisting their innovative ideas because of an unthinking conservatism. They seem oblivious to the irony, since their own proposal takes the technofix to a sublime plane, one made possible by an intensely individualistic understanding of the world, which sees

the failure to respond to climate change as arising not from political, institutional and cultural forces but from a lack of personal willpower. Rarely in intellectual history has such a dire social problem been so trivialized by this kind of psychologism. The authors are keen to stress they would never *compel* people to produce small children or grow cat's eyes, which only raises the question of why anyone who is unwilling to buy a smaller car or switch to green power would be willing to genetically engineer their children.

In his critique of the Royal Society's 2009 report on geoengineering, Gardiner poses the question bluntly: 'if the problem is social and political, why isn't the solution social and political as well [and] if, as the report asserts, we already have adequate scientific and technological solutions, why assume that research on alternative solutions will help?'⁴⁹ In the end, the answer from geoengineering supporters must lie in an implicit judgement that social change is inconceivable so the only answer is to buy time for the costs of renewable energy technologies to fall far enough or to prepare to deal with an inevitable climate emergency. Yet in investing so much in our ability to take control of the climate are we in danger of attempting to emulate God?

Playing God

Weapons scientists inside the fence at the Lawrence Livermore National Laboratory were divided from the anti-nuclear protesters at the gates less by their political leanings or religious beliefs than by their commitment to a Promethean as opposed to a Soterian worldview. In a similar way, the concern about Promethean overreach, often known as 'playing God', is not confined to theists but may resonate just as strongly with atheists. For atheists, 'playing

God' is a metaphor either for humans assuming God-like attributes or for mortals attempting to occupy a domain that is not properly theirs. In the first, the idea is that there are certain qualities that humans cannot and should not aspire to, both because they are beyond us and because aspiring to them invites calamity.⁵⁰ The philosopher Tony Coady identifies three attributes of God or the godhead that are beyond human capabilities – omniscience, omnipotence and supreme benevolence – which seem to capture the common sense.⁵¹ We will return to this meaning.

The second interpretation reflects a 'spatial' metaphysics of the world. Playing God entails humans crossing a boundary to a domain of control or causation that is beyond their rightful place. In this view, there is a limit to what humans should attempt or aspire to because the division between domains is part of the proper order of things. For theists, this other domain may be the dwelling place of God. For atheists, the domains are contained in an intuitive metaphysical order that defines 'the scheme of things' within which one can find what it means to be human. For both, the idea of staying out of 'God's realm' is an essentially Soterian outlook, sensitive to human shortcomings and the danger of ignoring them.

So what in practice is 'God's domain'? In the debate over human genetic enhancement the playing God argument has been prominent. Biologically, DNA is the essence of life, coding all of the information that makes an individual unique. As such, tinkering with genes (and especially the germ-line, or changes to DNA that can be passed on) can be seen by the theist as invading the sacred, or by the atheist as disturbing the essential dignity of the human. Michael Sandel argues that it is the gifted character of human capacities and potentialities that incites a natural reverence, and that there is something hubristic and unworthy about

attempting to overrule or improve upon this gift through genetic enhancement. Manipulating genes to human ends is 'a Promethean aspiration to remake nature, including human nature, to serve our purposes and satisfy our desires.'⁵² Life is reduced to a manipulable genetic code.⁵³

The particulars are not of much help in the case of geoengineering because we are not talking about transforming humans but the world in which humans live. Yet global dimming via sulphate aerosol injections is a similarly Promethean aspiration to remake 'nature' to serve our purposes, this time not at the microscopic level of DNA but at the macroscopic level of the Earth as a whole. The domain being invaded is not that of the essential code of each life but the sphere in which all life was created or emerged. With solar radiation management the concern is not so much a lack of gratitude for a unique and precious gift, but the invasion of and dominion over the atmosphere that encompasses the planet – the benevolent ring that makes it habitable, supplies the air breathed by all living things and sends the weather. In most cultures for as long as humans have lived, the sky has been the Heavens, the dwelling place of the gods. Global dimming would not only transform the atmosphere but also regulate the light reaching the Earth from the Sun. For some cultures the Sun has its own divine character because it is the source of all growth, the food of plants and thus all living things. It is the origin of the most primordial rhythms that have always governed our lives – the cycles of day and night and the annual seasons. For those cultures the Sun *is* God, and attempting to regulate it would surely be out of bounds. I mention these cultural facts not because they *prove* anything but to invoke in the sympathetic reader a feeling for the role of the Sun as a symbol of powers beyond the reach of mortals. The popular preference, revealed by many surveys, for solar energy over nuclear

power can probably be traced to a felt distinction between using a natural gift that flows freely to the Earth and relying on an unnatural and dangerous contrivance that has diabolical connotations. In general, people are more inclined to endorse technologies that appear to work with, rather than go against, nature.⁵⁴

So the intuition is that the grander schemes to regulate the climate trespass in a domain properly beyond the human. To cross over successfully would require mortals to possess a degree of omniscience and omnipotence that has always been reserved for God or the great processes of Nature that are rightly beyond human interference. To make matters worse, in this view, we want to supplant the gods in order to counter the mess we have made as faulty humans. Instead of embarking on a vain quest to mimic the gods, it seems safer and more within our powers to face up to our failures and attempt to become better humans. The usual appeals to the power of reason and science make little headway because they are deployed in the service of the same conquering spirit that drives the desire to play God, as if human ratiocination can function as a battering ram to enter the gods' domain, there to dethrone them and elevate humans in their place.

So the first argument against mimicking God is not about the dire *consequences* of entering the domain of the gods, but that playing God betrays a deep fault in the human character. What of the second caution about playing God, that human aspirations to omniscience, omnipotence and benevolence invite calamity? In modern times, we have come to believe that the relentless accumulation of scientific knowledge is taking us closer to total understanding. Recent developments in Earth system science have increased our knowledge substantially, but they have also uncovered cavernous gaps. We have come to see more clearly that the climate system is extremely complex both in itself and because

changes in it cannot be isolated from changes in the other elements of the Earth system. Human-induced warming is expected to reconfigure global precipitation patterns, but predictions of regional rainfall changes are very crude. The importance of tipping points' that define rapid shifts from one climate state to another have become apparent from the Earth's geological record, but our understanding of why and when they occur is rudimentary. Predicting when or how thresholds might be crossed is extremely imprecise. And how marine ecosystems will respond to acidifying oceans is barely grasped. In this light, *omniscience* appears as remote as ever.

Apart from the uncertainties, unknowns and threshold effects arising from the complexity and non-linearity of the Earth system, the dominant fact is that carbon dioxide persists in the atmosphere for many centuries. So it is possible – indeed, likely – that before the larger impacts of warming are felt, humans will have committed future generations to an irreversibly hostile climate lasting a thousand years. Yet some economists are telling us that they can use their models to estimate future streams of monetary costs and benefits to determine the optimal temperature of the Earth over the next two centuries, as if we know enough to install and begin to operate a 'global thermostat'. Truly this qualifies as monstrous hubris.

Humans are powerful, but what kind of power do we aspire to with climate engineering? Beyond deliberate management and exploitation of particular resources or geographical areas, and beyond the unintentional degradation of land, rivers and oceans, we now aspire to take control of and regulate the atmosphere and climate of the planet as a whole. As we will see in the next chapter, geoscientists are now arguing that humans have become a planetary force in their own right. We have so transformed the face of the

Earth that we have created a new geological epoch, one expected to be characterized by more climatic instability than the previous one. In other words, our Promethean aspirations have made the world less controllable.

If humans were sufficiently omniscient and omnipotent, would we, like God, use climate engineering methods *benevolently*? Earth system science cannot answer this question, but it hardly needs to, for we know the answer already. Given that humans are proposing to engineer the climate because of a cascade of institutional failings and self-interested behaviours, any suggestions that deployment of a solar shield would be done in a way that fulfilled the strongest principles of justice and compassion would lack credibility, to say the least. We find ourselves in a situation where geoengineering is being proposed because of our penchant for deceiving ourselves and inflating our virtues. If a just global warming solution cannot be found, who can believe in a just geoengineering regime? It is believed that a solar filter would offset some of the impacts of global warming more effectively in some parts of the world than others. In some areas it may even exacerbate droughts. The temptation of those who control the heat shield to manipulate it in a way that suits their interests first would be ever present and almost irresistible. And at no forum will non-human species have a voice. All of these anxieties are deepened by the creeping militarization of geoengineering and the possibility of unilateral deployment.

The playing God argument is not necessarily a categorical injunction against solar radiation management, but it does sound a warning about Promethean recklessness, calling for utmost caution and deep reflection. On one view, calculating risks is enough. On another, our attitudes and beliefs about ourselves and the nature of the world are so deeply ingrained that they necessarily constrain any calculative thinking to a narrow range of outcomes. According

to this Soterian view, if we are so mistaken in our understanding of the world and our role in it that we are drawn into playing God with the future of the planet, then thinking must be grounded in a different relationship between humans and the natural world, one that recognizes the boundary between the domain of mortals and that of the gods.