

Is “Arming the Future” with Geoengineering Really the Lesser Evil?

Some Doubts about the Ethics of Intentionally Manipulating the Climate System¹

by Stephen M. Gardiner (2010)

“So convenient it is to be a reasonable Creature, since it enables one to find or make a Reason for everything one has a mind to do.”²

– BENJAMIN FRANKLIN

I. An Idea that is Changing the World

The term *geoengineering* lacks a precise definition, but is widely held to imply the intentional manipulation of the environment on a global scale³. For most of the last thirty years, there has been a wide consensus that such manipulation would be a bad idea. However, in August 2006, Paul Crutzen, the climate scientist and Nobel Laureate, published an article which reignited debate about whether we should explore geoengineering “solutions” as a response to the escalating climate change problem.⁴ This was soon followed by other contributions and proposals⁵, and now interest in geoengineering has become widespread, in both academia and the world of policy. As a result, *Time* magazine recently listed geoengineering as one of its “Ten Ideas that are Changing the World”.⁶

Ethical discussion of geoengineering is made more difficult by the complexity of the terrain. 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 Legrance 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”?⁷

Second, different arguments can be (and often are) offered in favor of the same specific intervention. For example, some advocate a given geoengineering “solution” because they think it much more cost-effective than mitigation, others say that it will buy time while mitigation measures are implemented, and still others claim that geoengineering should only be implemented as a last resort, to stave off a catastrophe. Such differences in rationale are important because they often make for differences in research and policy implications. For example, they can affect what kinds of geoengineering should be pursued, to what extent, and with what safeguards.

In this paper, I will focus on one specific intervention, and one rationale being offered for it. The intervention is that of injecting sulphate aerosols into the stratosphere in order to block incoming solar radiation by modifying the Earth’s albedo.⁸ The rationale is a certain kind of “lesser evil” argument. It begins by conceding both that mitigation – direct and substantial reductions in anthropogenic emissions – is “by far” the best approach to climate policy, and that there is something morally problematic about geoengineering proposals. However, it goes on to claim that so far progress on the preferred policy has been minimal⁹, so that there is reason to revisit geoengineering options. In particular, it is argued, if the failure to act aggressively on mitigation continues, then at some point (probably 40 years or more into the future) we might end up facing a choice between allowing catastrophic impacts to occur, or engaging in geoengineering. Both, it

is conceded, are bad options. But engaging in geoengineering is less bad than allowing catastrophic climate change. Therefore, the argument continues, if we end up facing the choice, we should choose geoengineering. However, if we do not start doing serious research on geoengineering now, then we will not be in a position to choose that option should the nightmare scenario arise. Therefore, we should start doing that research now. (I call this the “Arm the Future” argument, or AFA.)

I focus on this combination of intervention and rationale for three reasons. First, it is currently the most popular proposal under consideration, and the one that most strongly motivates Crutzen. (For this reason, I shall label it ‘the Core Proposal’.¹⁰) Second, the focus on sulphate injection helps us to sidestep the definitional worries about what constitutes geoengineering: such direct intervention into the chemistry of the stratosphere appears to be a clear case.¹¹ Third, appeals to the lesser evil are attractive to a wide audience, including those who are otherwise strongly against technological intervention. Indeed, in the current context they are often seen as almost irresistible, constituting a straightforward and decisive move that no sane person could reject. Hence, such arguments seem among those most likely to justify geoengineering.

Geoengineering is a relatively new and underexplored topic. This is true both of the science and the ethics.¹² Just as we are not close to fully understanding exactly how to geoengineer if we were to choose to do so, or what the impacts of any geoengineering scheme would be, so we are also not sure how to understand the normative dimensions of undertaking geoengineering. In short, in moral and political philosophy, as in the science, robust theories of geoengineering are some way off. In this kind of setting, it is useful to begin by trying to get some sense of the terrain – of what the major issues might be, of how they might be investigated, and so of how understanding might move forward. This is the spirit of the current paper, and by far its most important aim.

Still, as a secondary matter, the paper will argue for three more specific conclusions. First, the Arm the Future Argument is far from straightforward or decisive. Instead, it assumes much that is contentious, and is overly narrow in its conclusions. Second, the argument obscures much of what is at stake in the ethics of geoengineering, including what it means to call something an “evil”, and whether doing evil has further moral implications. Third, the argument arises in a troubling context, and this implies that it should be viewed with suspicion. Climate change constitutes an especially serious challenge to ethical behavior because it involves the intersection of global, intergenerational, and theoretical obstacles to action. Because of this, *we* – the current generation, and especially those in the affluent countries – are particularly vulnerable to moral corruption, that is, to the subversion of our moral discourse to our own ends. In such a setting, we should be especially cautious about arguments that appear to diminish our moral responsibilities. As Franklin suggests in the opening epigraph, we must beware the “conveniences” of being “reasonable creatures”.

The discussion proceeds as follows. Sections II-III set out the context in which the Core Proposal emerges. Section IV presents some internal challenges to the Arm the Future Argument. Sections V-VI consider some more general challenges that face lesser evil arguments considered as such, and discuss why they may arise in the case of geoengineering. Finally, section VII summarizes the main conclusions of the paper and asks what lessons should be drawn for future discussions of geoengineering.

II. The Problem of Political Inertia

“The rise in global carbon dioxide emissions last year outpaced international researchers' most dire projections ...”¹³ – Juliet Eilperin (2008)

Before we turn to the Core Proposal itself, it is worth examining its context. Crutzen’s position is largely motivated by what I have called ‘the problem of political inertia’.¹⁴ Crutzen asserts that, despite the fact that mitigation is “by far the preferred way”¹⁵ to address climate change, so far efforts to lower carbon dioxide emissions have been “grossly unsuccessful”.¹⁶ The grounds for Crutzen’s skepticism are easy to see. Since 1990, when the threat of global climate change was firmly established by the first report of the Intergovernmental Panel on Climate Change, humanity’s overall response to climate change has been pretty disappointing. One sign of this is that both global emissions and the emissions of most major countries, such as the United States, have been increasing steadily during this period. For example, from 1990-2005, global emissions rose by almost thirty percent (from 6.164 to 7.985 billion metric tons of carbon), and U.S. emissions by just over twenty percent.¹⁷ Another sign is that global emissions have been growing even more rapidly in the recent past (from an average of 1.5-2% per annum to around 3% in 2007). Indeed, this growth is so rapid that they are currently at the very high end of projected emissions given back in 1990.¹⁸ Given such inertia, Crutzen infers that “there is little reason to be optimistic” about future reductions¹⁹; indeed, he asserts that the hope that the world will now act decisively is “a pious wish”.²⁰ This is his ultimate reason for proposing geoengineering.

If political inertia is the key problem, what causes it? Crutzen does not say. However, in my own view, a good part of the explanation is that global climate change constitutes “a perfect moral storm”²¹: the convergence of three nasty challenges (or “storms”) that threaten our ability to behave ethically. These three storms arise in the global, intergenerational and theoretical dimensions.

The global challenge is familiar. Both the sources and the effects of anthropogenic emissions are spread throughout the world, across local, national, and regional boundaries. According to many writers, this creates a tragedy of the commons situation, because the global system is not currently set up to govern this kind of commons. Worse, there are skewed vulnerabilities: those who are most vulnerable and least responsible will probably bear the brunt, at least in the short- to medium-term. This is because whereas the developed nations are, by and large, responsible for the bulk of emissions to this point, they appear much less vulnerable to the more immediate impacts than the less developed countries, where most of the world’s poor reside. This mismatch of vulnerability and responsibility is exacerbated by the fact that the developed countries are more powerful politically, and so more capable of bringing about a solution, but the less developed are poorly placed to call them to account.

The intergenerational challenge is less familiar. The impacts of climate change are subject to major time lags, implying that a large part of the problem is passed on to the future. One reason for this is that emissions of the main anthropogenic greenhouse gas, carbon dioxide, persist in the atmosphere for very long periods of time: even the typical carbon dioxide molecule remains for several hundred years, but 10-15% remains for ten thousand years, and 7% for one hundred thousand years. Given this, the full cost of any given generation’s emissions will not be realized during that generation’s lifetime. This suggests that each generation faces the temptation of intergenerational buck-passing: it can benefit from passing on the costs and/or harms of its behavior to future people, even when this is morally unjustified. Moreover, if the behavior of a given generation is primarily driven by its concerns about what happens during its own lifetime, then such overconsumption is likely.²²

The third challenge is theoretical. We do not yet have a good understanding of many of the ethical issues at stake in global warming policy. For example, we lack compelling approaches to issues such as scientific uncertainty, international justice, intergenerational justice, and the appropriate form of human relationships to animals and the rest of nature. This causes special difficulties given the presence of the other storms. In particular, given the intergenerational storm and the problem of skewed vulnerabilities, each generation of the affluent is susceptible to arguments for inaction (or inappropriate action) that shroud themselves in moral language but are actually weak, and self-deceptive. In other words, each generation of the affluent is vulnerable to moral corruption: if they give undue priority to what happens within their own lifetimes, they will welcome ways to justify overconsumption, and so give less scrutiny that they ought to arguments that license it. Such corruption is easily facilitated by the theoretical storm, and obscured by other features of the global storm.²³

Since the perfect moral storm makes us vulnerable to moral corruption, we should be on our guard. Naturally, then, the general question we should ask about any geoengineering proposal is whether it provides a way out of the perfect moral storm, or whether, instead, it amounts only to a serious manifestation of moral corruption. Hence, in the present case, the issue becomes: Is the Core Proposal (and the growing clamor in its favor) a solution, or part of the problem?

III. Two Preliminary Arguments

“The economics of geoengineering are—there is no better word for it—incredible.”²⁴
– Scott Barrett (2008)

The Core Proposal acknowledges that geoengineering is a bad thing. But why concede this? Why consider geoengineering an evil at all? To motivate this idea, it is useful to consider briefly two other arguments for geoengineering that lurk in the background.

1. The “Cost-Effectiveness” Argument

The first argument claims that geoengineering ought to be pursued simply because it is the most cost-effective solution to the climate crisis. Hence, some enthusiasts claim that albedo modification is relatively cheap and administratively simple to deploy. It is said to be relatively cheap because (it is claimed) the basic mechanism for inserting sulphur into the stratosphere, though expensive in absolute terms, is orders of magnitude cheaper than switching whole economies to alternative energy. It is said to be administratively simple because action need not require international agreement: in theory, the actual deployment could be done by one country or corporation acting alone.²⁵

The cost-effectiveness argument has not (yet) proven persuasive to many people. This is presumably because a number of important considerations seem to count against it. First, since the albedo modification plan does not remove emissions from the atmosphere, but rather allows their accumulation to continue accelerating, some important effects of carbon dioxide emissions – such as ocean acidification, and its implications for marine organisms and systems – remain untouched. Thus, at best, this intervention only deals with one part of the problem; and at worst, it implicitly assumes the deployment of further technological fixes, so that sulphate injection turns out to be only the tip of a geoengineering iceberg.²⁶

Second, the claim that albedo modification is cheap appears to focus only on the costs of actually delivering sulphur into the stratosphere, using cannons mounted on ships, or especially modified airliners. But this seems curiously myopic. (One doesn't decide whether to embark on brain surgery by focusing on the price of the knife.) In particular, it appears simply to *assume* that this kind of geoengineering will have no expensive side-effects. But worries about side-effect are, of course, many people's central reason for rejecting all geoengineering proposals.²⁷

Third, the claim that geoengineering is administratively simple appears morally and politically naïve.²⁸ Can we really imagine that major countries will happily stand aside while a single power or corporation modifies the climate without their input and oversight? At the very least – given that the effects of geoengineering are likely to vary across different countries and regions – won't there be debate about which kind of geoengineering should be pursued, and to what extent? Aren't there major issues of liability to be resolved? In short, isn't this the kind of issue on which international agreement will be absolutely necessary if serious social, economic, political and military conflict is to be avoided?

Finally, the basic cost-effectiveness argument ignores important issues about the human relationship to nature. Given the wider context of escalating species extinction, rampant deforestation, dramatic population increases, and so on, is it not cavalier to assume that the *only* issue that arises with climate change is whether to employ a “quick” and “cheap” technological fix? Moreover, some have even gone so far as to suggest that, even if successful, adopting a geoengineering “solution” might turn out to be worse for humanity in the long run than the problem it is supposed to solve: perhaps it would be better, all things considered, to endure a climate catastrophe than to encourage yet more risky interventions in, and further domination of, nature.²⁹

For these and other reasons, most people have concluded not only that the cost-effectiveness argument does not justify deliberate albedo modification, but also, on the contrary, that such intervention is something we have serious reason to avoid: an “evil” in the most modest sense.³⁰ This is an important claim, since it imposes a burden of proof on other arguments for this kind of geoengineering. They must show that its merits are, all things considered, serious enough to override the “evils” involved.

2. The “Research First” Argument

The second lurking argument comes from Ralph Cicerone, President of the National Academy of Sciences. Cicerone believes that we should separate out questions about research on geoengineering from those concerning actual deployment. On the one hand, he supports allowing research and peer-review publication, since this will help us to “weed out bad proposals” and “encourage good proposals”, and because knowledge is worthwhile for its own sake, a consideration that (he says) backs the normal presumption in favor of freedom of inquiry. On the other hand, Cicerone concedes that deployment raises special issues. Hence, he proposes that scientists get together and agree on a moratorium on testing or deploying geoengineering. Once some good concrete proposals have emerged from research, he believes that the process should be opened up to public participation.

There is something attractive about Cicerone's proposal, and about the model it implies of science and its role in society. However, there are serious concerns about how good that model really is, and in particular how it holds up in the real social and political world in which we live. To begin with, although almost everyone will like the idea of “weeding out” bad geoengineering proposals, Cicerone's aim of “encouraging” the good ones is contentious. So, much depends on his third

rationale: that we should promote the acquisition of knowledge for its own sake. But there are some significant issues here.

The first is that it is not obvious that any particular research project should be supported just because it enhances knowledge. To begin with, in the real world, there are limited resources for research. Since we cannot fully fund everything, projects compete with one another for funding and expertise. Given this, the claim that geoengineering research increases knowledge is insufficient to justify our pursuit of it. If we prioritize geoengineering, other knowledge-enhancing projects will be displaced. Some rationale is needed for this displacement.

Second, some kinds of knowledge-enhancement seem trivial. Suppose, for example, that someone proposes a project to count (not estimate) the number of blades of grass in each individual backyard in Washington State. Do we really have a reason to support this research? Presumably not. Similarly, some experts claim that geoengineering research may turn out to be in some sense trivial. For example, they suggest that it is highly unlikely to yield the kind of results needed to justify action on the timescale envisioned³¹, and that the rate of technological progress is so fast that it may make little sense even to try.³²

Third, there are such things as morally bad projects. Consider, for example, research whose aim is to find the maximally painful way in which to kill someone, or the cheapest way to commit genocide against a specific minority population. Arguably, if such projects succeed, they increase our knowledge. But it is not clear that this alone gives us reason to support them. Similarly, if, as we have seen suggested above, geoengineering really is some kind of evil, why encourage the pursuit of “good” ways to do it? Why not promote research with better aims (e.g., green technology)?³³ ...

The final issue with Cicerone’s argument is that it is not clear that geoengineering activities can really be limited to scientific research in the way that he suggests. First, there is such a thing as institutional momentum. In our culture, big projects that are started tend to get done.³⁴ This is partly because people like to justify their sunk costs; but it is also because starting usually creates a set of institutions whose mission it is to promote such projects.³⁵ For such reasons, sometimes the best time to prevent a project proceeding is before the costs are sunk and the institutions created. Second, there are real concerns about the idea of a moratorium. After all, if the results of research are to be published in mainstream journals that are freely available online or in libraries across the world, what is to stop some rogue scientist, engineer or government deciding to use that research? Third, there are worries about who gets to make such decisions and why, and about how they are enforced. If the future of the planet is at stake, why is it that the rest of humanity should cede the floor to a “gentleman’s agreement” among a specific set of scientists? Fourth, there are issues about conducting geoengineering research in isolation from public input, and in particular divorced from discussions about the ethics of deployment. The background assumption that is being made seems to be that such input and discussion has *nothing to tell us* about the goals of geoengineering research or how it should be conducted. But it is not clear why we should accept this assumption.³⁶ After all, many people do not accept it in the case of other important scientific issues, such as research on stem cells, genetic enhancement, and biological warfare.

In summary, stronger arguments are needed for considering substantial investment in geoengineering research, and a more robust account of the conditions under which deployment would be considered is also necessary. This is where lesser evil arguments enter the discussion.

IV. Arming the Future³⁷

*“Life’s toughest choices are not between good and bad, but between bad and worse. We call these choices between lesser evils. We know that whatever we choose, something important will be sacrificed. Whatever we do, someone will get hurt. Worst of all, we have to choose. We cannot wait for better information or advice or some new set of circumstances. We have to decide now, and we can be sure that there will be a price to pay. If we do not pay it ourselves, someone else will.”*³⁸

– Michael Ignatieff (2004)

If there is a presumption against geoengineering, how might this be met? One promising approach is based on the general idea that “we may reach the point at which [geoengineering] is the lesser of two evils”.³⁹ This idea has been influential in discussions about geoengineering for climate change since the earliest days, and has appealed to both its enthusiasts and its detractors.⁴⁰

1. The Basic Argument

The Core Proposal offers one kind of lesser evil argument, and so appears to fit neatly into this framework.⁴¹ As we have seen, the basic structure of this argument seems to be as follows:

- (AFA1) Reducing global emissions is by far the best way to address climate change.
- (AFA2) In the last fifteen years or so, there has been little progress on reducing emissions.
- (AFA3) There is little reason to think that this will change in the near future.
- (AFA4) If very substantial progress on emissions reduction is not made soon, then at some point (probably fifty years or more into the future) we may end up facing a choice between allowing catastrophic impacts to occur, or engaging in geoengineering.
- (AFA5) These are both bad options.
- (AFA6) But geoengineering is less bad.
- (AFA7) Therefore, if we are forced to choose, we should choose geoengineering.
- (AFA8) But if we do not start to do serious scientific research on geoengineering options soon, then we will not be in a position to choose it should the above scenario arise.
- (AFA9) Therefore, we need to start doing such research now.

The Arm the Future Argument is complex. But, on the surface at least, it does seem to be the right *kind* of argument. For one thing, it acknowledges that geoengineering is problematic, and that there is a burden of proof against it. For another, it offers a weighty moral reason to endorse geoengineering – that of preventing a catastrophe – and it is easy to see why this reason addresses the deficiencies of the Cost-Effectiveness and Research First arguments. The threat of catastrophe appears both to meet the burden of proof against geoengineering, and to justify prioritizing research on it over other kinds of research. Finally, the Arm the Future Argument appears to address one significant part of the perfect moral storm. Under the scenario it sketches, geoengineering research emerges as one way of assisting future generations. If the world really isn’t going to do very much about reducing emissions, then substantial investment in geoengineering research emerges as an alternative way in which we can meet our intergenerational obligations.

At first glance, then, the AFA appears to make a very strong, even overwhelming, case for geoengineering research, and also (under the stated circumstances) ultimate deployment. However, I will now argue that matters are not as straightforward as they initially seem. To begin with, we would do well to proceed with caution. In general, arguments from moral emergency are perennially popular in both private and public life, and for an obvious reason. Clearly, part of the

point of claiming that one is in morally exceptional circumstances is in order to secure an exemption from the usual norms and constraints of morality. But this fact should give us pause. After all, there will always be those who would prefer that morality not apply to them or their projects, and all of us are vulnerable to such thoughts at some time or other. Morality sometimes seems inconvenient to us (like truth, as Al Gore reminds us) – and in such cases we’d often like to have an exemption. Hence, we should be wary of arguments from emergency; clearly, they are open to manipulation.⁴² Moreover, as we have seen, in the case of climate change we have additional reason for caution: if climate change is a perfect moral storm, the incentives for moral corruption will be high.

2. [Three] Challenges

Given all this, the Core Proposal should be subjected to special scrutiny. In the remainder of this section, I will focus on [three] challenges that face the AFA. In the following two sections, I will raise some wider worries that apply to lesser evil arguments considered more generally.

(i) *Which Nightmare?*

The first challenge concerns whether the nightmare scenario is the relevant emergency. In general, we should not simply accept *as a stipulation* that some policy that is said to be an evil (like geoengineering) should be endorsed because under some circumstances it would be a lesser evil than some other policy (such as allowing a catastrophic climate change). Instead, we should ask important questions such as: How likely is this emergency situation (where one has actually to decide between these two options) to arise? Is it the most relevant emergency situation? Is it true that the two evils are the only alternatives? Is the lesser evil really lesser, all-things-considered?

As it happens, the answers to these questions seem very much in doubt in the present case. ...

Second, in one respect the Core Proposal may not be neutral here. The Arm the Future Argument proceeds as if the decision to do research will have no influence on the likelihood of the nightmare situation’s arising. But it is not clear what justifies this assumption. Many people worry that substantial research on geoengineering will itself encourage political inertia on mitigation, and so bring on the nightmare scenario and deployment.⁴⁵ If this is so, we may have strong reason to limit or resist such research at this stage. We do not want to create a self-fulfilling prophecy. ...

(ii) *Other Options?*

The second challenge to the Core Proposal concerns its account of the current options. The Arm the Future Argument does not involve a straightforward appeal to moral emergency, since it explicitly concedes that the nightmare scenario is not *yet* upon us. According to the argument, we are not *now* in the relevant lesser evil situation, having to choose between the evils of allowing catastrophe and pursuing geoengineering⁴⁷; instead, the decision currently to be made is about whether and how to prepare for such a situation.⁴⁸

This shift is important because it puts questions about how the emergency is supposed to arise back in play. One of the usual effects of actually being in an emergency is to make many of the background conditions much less salient. For example, if I see a small child drowning in a pond, whom I could easily save just by reaching down to pick him out, we do not normally think that I should stop to mull over questions such as how he came to be there, and who is officially responsible for saving him. The relevant question is what to do here and now. But none of this is

the case if one is *anticipating* an emergency. Then it is perfectly appropriate to consider how the emergency might arise.

First, sometimes the best way to plan for an emergency is to *prevent* its arising. In the case of the pond, for example, one might erect a small wall to prevent toddlers falling in. Similarly, suppose – as the AFA suggests – that we are interested in preventing a catastrophic climate change brought on by the failure to reduce emissions directly, through regulation and political leadership. Even given this failure, we still have other options. For example, perhaps we can prevent the emergency by indirect means, such as by investing in a massive “Manhattan Project” that produces very cheap alternative energy by 2030.⁴⁹ The general point here is that if a good option is available that will prevent the emergency situation arising, the fact that we would choose a (lesser) evil if it did arise may be irrelevant to what to do now.⁵⁰ Again, the nightmare scenario loses its salience.

Second, considering how the emergency might arise can also help us to put other options on the table for dealing with it even if it does ultimately come about. In the present case, the AFA implicitly suggests that the *very best* we can do now to help future people faced with the threat of an imminent climate catastrophe is to research geoengineering. But this claim is unsupported and open to challenge. Most conspicuously, there are other ways in which we might aid future people on the brink of such a calamity. For example, perhaps we could prepare them for a massive emergency deployment of existing alternative energy technology (e.g., we could establish a Strategic Solar Panel Reserve), or perhaps we could establish a robust international climate assistance and refugee program, or perhaps we could do both of these things, together with any number of other alternatives. In addition, there may be a presumption in favor of alternatives that are (by contrast with geoengineering) not “evil in any sense. In any case, their relative merits should be discussed.

(iii) Additional Liabilities?

The third challenge facing the Core Proposal concerns additional liabilities. The AFA concedes that it is probably not *us* – our generation – who will actually make the decision to deploy the lesser evil.⁵¹ Most writers appear to assume that the nightmare scenario will not unfold until the second half of this century at the earliest, if at all.⁵² ...

[I]t seems highly likely that, if the nightmare scenario arises, it will confront future generations, not the current generation. The Arm the Future Argument tends to obscure this point by referring to what “we” will be forced to choose, where this refers to some temporally extended sense of “we”, such as humanity as such, or the United States considered across time. But once the point is made clear, the role of the argument becomes to imply that the responsibility of the current generation is (merely) to aid future generations in choosing the best kind of geoengineering possible. Unfortunately, this conclusion tends to obscure a vital moral feature of the situation: the potential crisis is to be brought about by *our* (the current generation’s) *failure* to pursue better climate policies.⁵⁵ Acknowledging this matters because there seems to be an important moral difference between (on the one hand) preparing for an emergency, and (on the other hand) preparing for an emergency that is *to be brought about by one’s own moral failure*.

Many things might be said about this. But here let me make just a couple of remarks. First, if someone puts others in a very bad situation through a moral failure, we usually do not think it enough for her to respond merely by offering the victims an evil way out. Instead, we believe that the perpetrator has substantial obligations to help the victims find better alternatives, and also, if the alternatives are costly or harmful, to compensate them for making this necessary. If this is right,

then even if the Arm the Future Argument were correct in other respects, we should not conclude from it that current people owe future generations *only* research on geoengineering; much more seems required. For example, we might owe them a very substantial compensation fund, or we might be obliged to run graver risks ourselves on their behalf. These are potentially very serious implications. For example, if we force a risky geoengineering project onto future people, we might have to compensate them with a massive climate assistance and refugee program, potentially amounting to a global safety net. Similarly, if the threat of catastrophe is extreme, we may be required to forestall it by attempting risky geoengineering on ourselves.⁵⁶

Second, concerns about additional liabilities are heightened in circumstances where we fail to do what we ought to prevent a catastrophic evil *partly because* we know in advance that a lesser evil solution will still be available to others. For example, suppose that we knowingly allow a crisis to unfold, which we could prevent by taking a nonevil option open to us. Suppose also that we do this partly because we know that others will eventually be forced to step in to prevent the coming catastrophe, even though they will have to accept significant evils in order to do so. Finally, add to this that we act in this way simply because we want to secure some modest benefits for ourselves.⁵⁷ Surely, such *calculated moral failure* would make us liable for even greater burdens, both compensatory and punitive. ...

3. Refining the AFA?

... [T]he suggestion that the problem of political inertia is so bad that we should organize our policy around geoengineering research alone (deferring or ignoring other ethical considerations) embodies a profound skepticism that should not be conceded without argument. After all, the thought is that neither mitigation, nor adaptation, nor alternative energy, nor compensation, nor geopolitical reform, nor even more extensive geoengineering research has a realistic chance of political success. But why accept this? And if things are really so bad, why think that “moderate geoengineering research only” has better prospects?

... [N]ot only is such profound skepticism questionable, but its truth would have further important moral implications. If a large number of alternative policies would be preferable, but none are available because of *our own* political inertia, the scale of our moral failure in choosing modest research at this point would be immense. But this suggests that the sense in which we are now *morally required* to pursue such a policy is sharply attenuated.⁶⁷ How are we to understand the force of the obligation to facilitate the lesser evil when we are so conspicuously refusing all prior (and many nonevil) moral demands? Is there not a worrying moral schizophrenia underlying this proposal?⁶⁸ ...

For such reasons, I conclude that, as it stands the AFA is seriously underdetermined, and that efforts to rectify this face substantial obstacles. Because of this, the case for both research on, and ultimate deployment of, geoengineering is far from being straightforward or irresistible. I will now consider some more general worries about lesser evil arguments which strengthen this conclusion.

V. Underestimating Evil?

“One might have the idea that the unthinkable was itself a moral category ... in the sense that [a man] would not entertain the idea of doing [such actions] ... Entertaining certain alternatives, regarding them indeed as alternatives, is itself something that he regards as dishonourable or morally absurd.”⁷²

– Bernard Williams (1973)

What does it mean to choose the lesser evil? What is at stake? We can begin by acknowledging that there is something morally appealing about the notion of choosing the lesser evil in a situation of grave crisis. Such a choice can seem heroic, even to display a deep moral seriousness. One reason for this is that most people seem to believe that there are circumstances when the consequences are so severe that normal rules must be overridden. Another is that a strong rigorism about moral rules often seems morally unattractive, perhaps even an irrational fetish.

To illustrate the attractiveness of these thoughts, consider the case of the enquiring murderer famously discussed by Kant. In one version of this case, you are confronted with a Nazi stormtrooper asking whether you are hiding Jews in your house. As it happens, you are. Since lying is normally immoral, are you morally bound to tell the stormtrooper the truth? Most people think not. Sticking to the normal rules in such cases, they believe, would be deeply bizarre: a morally serious person could not do such a thing. Similarly, the lesser evil argument can seem overwhelmingly appealing in the case of geoengineering. Faced with a possible catastrophe, why wouldn't one try geoengineering? Wouldn't failure to do so constitute an irrational fetish?

Clearly, such concerns are important. But matters are not as simple here as they initially seem. To see this, consider the following three obstacles that a lesser evil argument must seek to overcome.

1. Opacity

The first is the problem of opacity. In the abstract form in which they are usually presented, lesser evil arguments are often inscrutable.⁷³ For one thing, we are asked simply to compare two bad options and rank one as lesser; but we are not usually asked for the reasons for our rankings. For another, the options themselves are frequently underdescribed. Such opacity creates concerns. ...

2. Denial

The second obstacle facing lesser evil arguments is the problem of denial. Some may simply refuse to accept that the lesser evil should be chosen under any circumstances: a lesser evil is still an evil, they will say, and *therefore* not to be chosen. This, of course, is Kant's attitude to the enquiring murderer case. One ought not to lie *simpliciter* is his position, and let the chips fall where they may.

Now, most people do not find Kant's position compelling in this case. But we should be wary of simply rejecting it out of hand. For one thing, even in the case of the inquiring murderer, it is difficult to *show* how or why an uncompromising attitude is irrational, or otherwise in error. More importantly, even if most of us do not agree with Kant in that case, there are situations in which the same kind of attitude seems more plausible. For example, suppose some great evil could be prevented if you would just kill your own grandmother in cold blood. (If necessary, embellish the case. For example, imagine that your grandmother is morally innocent and that the killing would be against her wishes.) Is it so obvious that you should do this? Surely one can understand why a person might resist, and for reasons that seem at least possibly morally appropriate. ...

3. The Unthinkable

At first glance, it may seem that these points stand or fall with the assertion of the strong and uncompromising view that evil ought never to be done. But in fact one need not go this far. First, finer-grained distinctions are possible. Consider, for example, what Bernard Williams says about

the category he calls the “unthinkable”: “entertaining certain alternatives, regarding them indeed as alternatives, is itself something that [someone] regards as dishonourable or morally absurd.”⁷⁷ Perhaps not all “evils” are also unthinkable, and those that are not might sometimes be chosen. Still, if some evils are unthinkable, then one cannot be confident that lesser evil arguments will always go through. Perhaps some evils are “lesser” than others in some respects, but still nonetheless unthinkable.⁷⁸ In that case, merely showing that an evil is lesser will not be enough to justify action.

Second, Williams’ focus is not on what should be done, but rather on what options should be entertained. His central claim is that it is dishonorable to regard certain options as legitimate alternatives. . . . Importantly, this thought seems pertinent in the current case. One can certainly see someone arguing that *advance planning* for a nightmare scenario is itself morally inappropriate when that nightmare is to be brought on by *one’s own future moral failure*. Hence, some will say that it is morally inappropriate to start planning for geoengineering when mitigation and adaptation are still on the table; instead, all our energies and efforts should go into preventing the nightmare scenario – where geoengineering starts to look acceptable - from arising.

To illustrate the appeal of this attitude, consider a related lesser evil argument. Call this, the Survival Argument:

If very substantial progress on emissions reduction is not made soon, then the world may plunge into chaos because of catastrophic climate change. If this happens, my family may face a choice between starvation and fighting for its own survival. Both starvation and fighting for survival are bad options. But fighting for survival is less bad. Therefore, if we are forced to choose, we should choose fighting for survival. But if we do not begin serious preparations for fighting for survival now, then we will not be in a position to choose that option should the circumstance arise. Therefore, my family needs to commence serious preparations for fighting for survival now.

What do we think of this argument? Should we arm ourselves, build fortified camps in the boonies, withdraw our children from school and train them instead in wilderness survival and combat, and so on? Wouldn’t this be a lesser evil than entering the world of climate chaos unprepared? Perhaps. Still, it seems plausible to say that devoting ourselves to such a strategy at this point in time is not merely unwarranted, but also an unacceptable evasion of moral responsibility. The Survival Argument – with its focus on the lesser evil – ignores this, and so is to be criticized. This suggests a general flaw in hypothetical lesser evil arguments, and one that the Arm the Future Argument may share. . . .

4. Marring Evils

This thought leads to the third obstacle facing lesser evil arguments. As it happens, many people – Williams included – believe that even actions that are normally “unthinkable” must sometimes be done.⁸⁰ Yet, even when there is agreement that certain evils are of this sort, people have different attitudes to the relevant moral emergencies. One might be aptly described in terms of the well-known bumper sticker slogan, “Shit Happens”. On this view, the occurrence of a lesser evil situation is an unfortunate fact about the world, more serious than, but otherwise akin to, other shifts in empirical circumstances. But another attitude is quite different. To see this, consider the following classic case. In his novel *Sophie’s Choice*, William Styron tells the tragic tale of Sophie, a mother who is put in a situation where she must choose between saving one of her children or submitting both to be killed by the Nazis. Sophie chooses to save her son, but relinquish her

daughter. The novel explores her subsequent life as she deals with the fact of her choice and its consequences. Ultimately, Sophie kills herself, unable to come to terms with the decision she made.

Sophie's Choice is a modern literary classic. But it is also of philosophical interest. Most people agree that Sophie's suicide is tragic. For many, this is because they believe that she wrongly blames herself for the death of her daughter. The situation in which she found herself was, it is said, monstrously difficult. Nevertheless, she did the right thing in choosing, and ought not to be wracked by guilt. Others are to blame, not Sophie. She should recognize that and feel better about herself. Perhaps she should even praise herself for being able to make the decision to save at least one person's life (her son's) under such emotionally difficult circumstances. (After all, "shit happens".) For others, however, Sophie's suicide is tragic in a more traditional sense. Sophie does not make a moral mistake. Even though she makes a defensible (perhaps even "the best"⁸¹) decision in that terrible situation, and even though she bears no responsibility for being in it, still she is right to think that her choice carries negative moral baggage. Though she is not to be blamed for the decision in the usual way, it is nevertheless true that her life is irredeemably *marred* by it.⁸² Though we might admire Sophie in certain respects, no one would say that she lives the kind of life that it is desirable for a human being to live. No one would want to be Sophie.⁸³ Interestingly, this second attitude seems to be Sophie's own, and the one that ultimately leads her to suicide. She says: "In some way I know I should feel no badness over something I done like that. I see that it was – oh, you know – beyond my control, but it is still so terrible to wake up these many mornings with a memory of that, having to live with it. When you add it to all the other bad things I done, it makes everything unbearable. Just unbearable."⁸⁴

The idea that a life can be marred from a moral point of view, and possibly irredeemably, is a controversial one in moral theory. ... I propose using the phrase 'marring evil' in a special, technical sense, to refer to a negative moral evaluation of an agent's action (or actions), that is licensed when the agent (justifiably) chooses the lesser evil in a morally tragic situation, and which results in a serious negative moral assessment of that agent's life considered as a whole.⁸⁵ ...

[L]et us return to Sophie. The dispute over how to understand her choice is sometimes described as turning on the question of whether or not there are genuine moral dilemmas: situations in which an agent cannot help but act in a way that is morally reprehensible in at least some sense. Those in the first camp say that there are no genuine moral dilemmas – and so no "marring evils" in my sense – those in the second say that there are. Now, I suspect that many of you are already thinking that a discussion of *Sophie's Choice* seems oddly (perhaps even shockingly) out of place in a paper on climate change and geoengineering. I admit that Sophie's choice is an extreme case. Nevertheless, I mention it because attention to the dispute about genuine moral dilemmas helps us to see some important issues within the ethics of geoengineering. ...

[I]f such evils exist, this raises a question about whether putting someone in a marring situation – one where they might be required (or have strong reason) to incur such an evil – constitutes a special kind of moral wrong, or at least one which greatly increases the moral gravity of the action. Surely, the thought goes, there is a significant moral difference between putting others in a situation where they must choose between (normally) bad options, and putting them in a situation where their choice will tarnish or even blight their lives. Other things being equal, we have much stronger reason to avoid the latter situation, and so are liable to greater censure if we fail to do so. Indeed, this reason may be so strong that ignoring it – and so unnecessarily inflicting a marring choice on others – itself counts as an evil that blights *our* lives.

This ... may turn out to be especially serious in the case of climate change. Consider just two kinds of case. First, perhaps the inaction of some countries (e.g., the high-emitting developed countries) will inflict marring choices on the people of other countries (e.g., the lower emitting developing countries). For example, if current and past emissions cause Bangladesh to flood and force its people to migrate, it is not beyond the realm of possibility that some parents (or the Bangladeshi government, or other agencies) may be placed in situations similar to the one confronting Sophie. Second, the current generation, by exploiting its temporal position, may put some future generation in a position where it must make a marring choice. For example, perhaps our actions will cause that future generation to confront an abrupt climate change so severe that they must choose to burn a large amount of fossil fuel in order to prevent an immediate humanitarian disaster, even knowing that this will then impose further catastrophes on some later generation.⁸⁹ In this case, we are responsible for putting the first future generation in a position where it must inflict a great harm on the second, and so mar itself. This seems to be a serious moral wrong on our part. It may also be a blighting evil.

VI. A Climate of Evil

*“The arrogance of human beings is just astounding.”*⁹⁰ – Oceanographer Sally Chisholm (1995)

Of course, none of the above explains why geoengineering specifically might bring on a marring evil. Presumably, successfully answering this question would require a much larger project. Moreover, since here we are only trying to survey the moral terrain, an answer is not strictly necessary. Still, since the very idea of marring is controversial in itself, and perhaps especially so when applied to geoengineering, it may be worth at least gesturing at the shape the relevant reasons may take.

Some possibilities emerge from considering how many climate scientists (some specifically responding to the Core Proposal) argue against geoengineering. First, it is common to imply that pursuing geoengineering manifests arrogance and recklessness. For example, Jeff Kiehl writes: “On the issue of ethics, I feel we would be taking on the *ultimate state of hubris* to believe we can control Earth. We (the industrially developed world) would essentially be telling the (rest of the) world *not to worry* about our insatiable use of energy.”⁹¹ ...

Second, climate scientists frequently claim that pursuing geoengineering represents a kind of blindness, a failure on the part of humanity to address the underlying problem. For example, Kiehl says, “In essence we are treating the symptom, not the cause. Our species needs to begin to address the cause(s) behind the problem.”⁹³ Moreover, it is often suggested that this reluctance to address the underlying problem is somehow shortsighted, obstinate, or even bizarre. For example, Schneider likens the climate change problem to heroin addiction, and compares the decision to pursue geoengineering to choosing “a massive substitution of [planetary] methadone” over “slowly and surely” weaning the addict.⁹⁴ ...

In short, one worry that these scientists have about the decision to pursue geoengineering concerns what it might show about us: our lives, our communities, our generation, our countries, and ultimately our species. What kind of people would make the choice to geoengineer? Would they be reckless, hubristic, and obstinate people? Would this be a generation or country consumed by its own (perhaps shallow) conception of its own interests, and utterly indifferent to the suffering and risks imposed on others? Would it be a species that was failing to respond to a basic evolutionary challenge?

Such concerns are relevant to political inertia over climate change in general. On one natural way of looking at things, groups with which many of us identify are predominantly responsible for creating the problem, are currently largely ignoring the problem, and are also refusing to address the problem in the best way possible because of a strong attachment to lesser values. These are serious moral concerns, and give rise to substantial moral criticism. Who would want to be associated with such groups and implicated in such behavior? Are we not saddened, even ashamed? Is this not a tarnishing evil?

Perhaps. But what about geoengineering specifically? Why might choosing it tarnish a life? ...

Consider first those who cause the nightmare scenario to arise. One way in which our lives might be tarnished would be if the commitment to geoengineering becomes a vehicle through which we (e.g., our nation and/or our generation) try to disguise our exploitation of other nations, generations, and species. Specifically, our willingness to facilitate (or engage in) geoengineering might show that we have failed to take on the challenge facing us, and instead have succumbed to moral corruption. Indeed, the decision to geoengineer might reveal *just how far we are prepared to go* to avoid confronting climate change directly, and this may constitute a tarnishing, even blighting, evil. Think about what people mean when, in tragic circumstances, they say: *“Has it really come to this?”*⁹⁶

Consider now those who choose geoengineering as the lesser evil in some nightmare scenario. Why might this be marring? One reason is that through their choice they inflict grave harms on innocents that may otherwise not have occurred. Suppose, for example, that geoengineering really does cause less harm than climate catastrophe, but that this harm accrues to different individuals.⁹⁷ In that case, when we choose geoengineering innocents are harmed through our agency, and this may be a marring evil (even if it is a “lesser” evil overall). One can certainly imagine it being something that people find, as the expression goes, “hard to live with”. Indeed, this is a prominent feature of other marring cases.⁹⁸ ...

[W]e have, in elementary terms, “fouled the nest”. We could clean it up – that would be the most direct approach, the one most likely to work – but so intent are we on continuing our messy habits, that we will pursue any means to avoid that, even those that impose huge risks on others and involve further alienation from nature.¹⁰⁰ In this case, so the thought goes, the decision to geoengineer constitutes the crossing of a new threshold on the spectrum of environmental recklessness, and so embodies a recognition of our continued and deepening failure. On this view, it is natural to think that it will be a sad and shameful day in the life of humanity when such a decision is made, that (if the choice is “forced” as a lesser evil) such a decision mars the lives of those who make it, that it blights those who bring about the nightmare situation, and perhaps even that it tarnishes humanity as such. ...

VII. But... Should We Do It?

In conclusion, the purpose of this paper has been to survey some of the moral landscape relevant to geoengineering. This has been done through an exploration of one popular proposal, at the heart of which is the Arm the Future Argument. This argument is often presented as offering a straightforward and decisive case for research on geoengineering. I have argued that this is not so.

...

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NOTES

1 Earlier versions of this paper were presented to the *Ethics and Climate Change* conference at the University of Washington, the *Global Justice and Climate Change* conference at Oxford University, the conference *Human Flourishing, Restoration and Climate Change* at Clemson University, a European Science Foundation Exploratory Seminar at the University of Oslo, the Department of Philosophy at the University of California, San Diego, and the annual meetings of the *American Association for the Advancement of Science* in San Francisco, and the *Association for Legal and Social Philosophy* in the United Kingdom. I am grateful to those audiences, and especially to Richard Arneson, David Brink, Simon Caney, Ralph Cicerone, James Fleming, Espen Gamlund, Michael Gillespie, Mathew Humphrey, Dale Jamieson, Monte Johnson, Richard Miller, Henry Shue, and Richard Somerville. I also thank Jeremy Bendik-Keymer, Allen Thompson, and especially Don Maier for careful written comments.

2 Franklin 1986, chapter 4.

3 Schelling 1996; Keith 2000.

4 Crutzen 2006. Crutzen's piece appeared in *Climatic Change*, accompanied by a set of responses from other distinguished scientists, including Bengtsson 2006; Cicerone 2006; McCracken 2006; Kiehl 2006; Lawrence 2006.

5 Such as Wigley 2006.

6 Walsh 2008.

7 For an overview, see Keith 2000.

8 This approach is appealing in large part because it has a natural precedent whose implications are generally understood: the aim is to simulate the known cooling effects of a large volcanic eruption. However, it should be noted that whereas volcanic eruptions are usually isolated events whose effects on temperature last only a year or two, the geoengineering proposal involves continuous injections of aerosols for a period of at least decades and possibly centuries. Not only is this a different proposition - amounting to continuous sustained eruption rather than an isolated event - but there are worries that it soon becomes effectively irreversible. First, because the sulphate particles only mask the effects of increasing greenhouse gas concentrations in the atmosphere, and because they dissipate quickly, any attempt to halt the experiment would probably commit the Earth to a swift rebound effect. Second, if the masking effect is large, then the rebound effect will likely also be so, and this is so in the current case. Under the circumstances envisaged by the current proposal, the masking effect is of comparable magnitude (2-6 degrees Celsius) to the kind of catastrophic climate change that the intervention is trying to prevent. Third, since the speed of the change is itself a factor, this would probably make unmasking worse than allowing the original climate change. Hence, many scientists believe that once we have been doing sulphate injection for a while, we will in effect be committed to continuing indefinitely (e.g., Matthews and Caldeira 2007).

9 We could add to this that there has been a similar lack of progress on the other necessary policy: adaptation.

10 Crutzen is far from the first to advocate the Core Proposal. As Stephen Schneider put it: "In this case, the messenger is the message" (Morton 2007, 133).

11 The role of the sulphate example is simply to focus our attention on clear cases of geoengineering. Presumably, other clear cases would serve just as well; hence, the paper has wider application.

12 In ethics, the exception is the groundbreaking Jamieson 1996. Other early articles with something to say about ethics include Bodansky 1996, Keith 2000a, Schelling 1996, and Schneider 1996, 1974.

13 Eilperin 2008. 14

The centrality of the problem of political inertia can be obscured by the fact that Crutzen initially gives most prominence to a different aerosol problem: as policy makers try to tackle normal air pollution problems by reducing sulphur dioxide emissions, then they will thereby increase global warming, and the increase may be dramatic. However, despite the prominence Crutzen gives this "Catch-22" situation, the problem of inertia appears more fundamental for him. He explicitly claims that the aerosol problem could be solved through mitigation, and indeed that this would be the best solution: "By far the preferred way to resolve the policy makers' dilemma is to lower the emissions of the greenhouse gases" (Crutzen 2006, 211-2; see also 217). Hence, his view is *not* that the aerosol problem as such makes geoengineering necessary (e.g., because it puts us into new territory, where mitigation alone will not be enough, so that geoengineering must be considered as well).

15 Crutzen 2006, 211.

16 Crutzen 2006, 212.

17 Marland et al., 2008.

18 Moore 2008.

19 Crutzen 2006, 217.

20 Crutzen 2006, 217.

21 Gardiner 2006, and BOOK.

22 In my view, such buck-passing is already manifest in recent climate change policy. See Gardiner 2004 [GWT], BOOK.

23 I say more about moral corruption in BOOK.

24 Barrett 2008, 49.

25 Schelling 1996, Barrett 2008.

26 Cf. Lovelock 2008, 3887.

27 For example, some are concerned that sulphate injection may lead to further destruction of stratospheric ozone. Crutzen (himself a pioneer of the ozone problem) is optimistic that this problem is small, given the quantity of sulphate to be injected, and also

suggests that alternatives to sulphates might be tried. But, as he acknowledges, this requires more research. (See Crutzen 2006, 215-6).

28 Bodansky 1996.

29 Jamieson 1996.

30 I consider less modest senses in section IV.

31 Bengtsson 2006, 233.

32 Thomas Schelling warns that if we are preparing for intervention that is fifty years or more off, this may be pointless preparation: technological change over such a period may be so profound as to make the preparation worthless. The precise import of this claim is unclear. (Perhaps we should prepare less than we might otherwise do? Perhaps we should do comparatively more basic climate research for geoengineering and less technical research?) But it does cast doubt on the claim that the best we can do for future generations is geoengineering research. See Schelling 1996.

33 Some scientists sympathetic to Cicerone's argument are confident that, in the end, there are no good geoengineering proposals to be had. Hence, they support research on the grounds that it will reveal this "fact" more clearly, and so prevent geoengineering strategies from being implemented merely for political reasons. But this is a different rationale. Note that it assumes not only that good proposals will not emerge, but also that further science will be enough to circumvent the political forces in favor of geoengineering (even when existing science has not), and that it is worth "wasting" scarce scientific resources in this effort.

34 Jamieson 1996.

35 Don Maier also suggests to me (i) that often such institutions compete, so that we should expect geoengineering institutions to discourage those that promote mitigation, and (ii) that such institutions create psychological momentum: individuals do not like to abandon projects in which they have invested time, energy, money, and emotion.

36 Jamieson argues for just the opposite conclusion: that geoengineering research could only be justified if accompanied by research into the ethics of geoengineering. (Jamieson 1996.)

37 Some parts of this section draw on Gardiner 2007.

38 Ignatieff 2004, vii (*italics in original*).

39 Jamieson 1996, 332-3.

40 For example, Stephen Schneider, himself generally an opponent of geoengineering, reports that, back in 1992, the concerns of a National Academy of Science panel were "effectively countered" by the following argument: "Let us assume ... that ... the next generation of scientific assessments ... converged on confidently forecasting that the earth had become committed to climate change ... serious enough to either require a dramatic retrenchment from our fossil fuel based economy ... or to endure catastrophic climatic changes. Under such a scenario, *we would simply have to practice geoengineering as the "least evil" ...*" (Schneider 1996, 295-6; *emphasis added*). Schneider attributes the argument to Robert Frosh.

41 Crutzen specifically cites the Schneider passage, with approval.

42 Indeed, this helps to explain why arguments from emergency - and declarations of states of emergency when normal political processes and rights are suspended - are often employed by political despots.

45 It may also facilitate inertia on adaptation, and so increase the severity of any given climate catastrophe by undermining people's ability to cope.

47 Crutzen is explicit about this: the idea is that we must prepare for the possibility of an emergency, not that we are actually in one right now. Hence, his core position is that we should develop geoengineering to serve as a backstop technology, to deploy if the situation eventually deteriorates. The Arm the Future Argument is explicitly a "backstop argument".

48 One could embellish the Arm the Future Argument to claim that we are already in a different lesser evil situation. So, suppose the argument is: (1) current research on geoengineering is an evil, because it really does increase the probability of deployment; but (2) given the possibility of the nightmare scenario, we must take the risk and choose this evil; and (3) we must do so *now*, or else risk being too late. This embellishment probably makes the original argument more promising. Nevertheless, it seems to be undermined by many of the other considerations raised in the text. For one thing, we (now) have alternatives to geoengineering including mitigation and investment in alternative energy, to name just two; for another, there are serious questions about whether geoengineering research will succeed, and about whether this is even a good time to begin.

49 Some have argued that such an approach is not only more feasible than geoengineering, but also secures a better outcome. Consider Bengtsson's response to Crutzen, where he concludes: "I do consider it more feasible to succeed in solving the world's energy problem, which is the main cause to the present concern about climate change, than to successfully manage a geoengineering experiment on this scale and magnitude, which even if it works is unable to solve all problems with the very high concentration of greenhouse gases in the atmosphere." (Bengtsson 2006, 233)

50 Schelling 1996.

51 I say something about the effects of relaxing this assumption at the end of the paper.

52 Schelling, for example, explicitly assumes that the decision is at least fifty years off.

55 This is something that Crutzen himself is very clear about: he argues that we ought to pursue mitigation, but we probably won't; therefore, he concludes, we should research geoengineering.

56 Cf. Wigley 2006. This possibility reveals that not all geoengineering proposals need manifest intergenerational moral corruption. For example, the attempt to "buy time" by geoengineering may pose more threats to current than future people. If so, they hardly manifest "buck-passing". (Of course, there are other reasons to resist them, especially if they are very risky, or if they pose disproportionate threats to the world's poor.)

57 Suppose, for example, that it is my child in the pond, that I let her climb in, that I then just watch the drowning, knowing that you will jump in, and that I do all this even though you are old, much further away, and risk a heart attack from the exertion, while I am young and merely concerned about getting my shoes muddy.

67 See also the wilderness survival example offered above.

68 The idea that approaches to important moral questions may exhibit some kind of schizophrenia is pioneered by Michael Stocker (1976). I cannot pursue it here.

72 Smart and Williams 1973.

73 This worry is especially relevant in the case of geoengineering, where the lesser evil claim is typically not so much argued for as simply asserted as decisive in a sentence or two before the discussion moves on. Of course, lesser evil arguments need not be opaque; but – for the reasons mentioned below - we should pay special attention to opacity when the threat of moral corruption is high.

77 See the epigraph to this section, and Smart and Williams 1973.

78 For example, suppose that coldblooded murder is a lesser evil than genocide, but still unthinkable.

80 Williams concedes that Jim should shooting the Indian in his classic case. His worry is that utilitarianism comes to this conclusion far too quickly, without realizing what is at stake for the agent in the decision.

81 In my own view, Sophie's choice is probably not the best; still, I do not think that we should blame her for it, nor do I believe that it is the existence of some alternative that produces the marring effect.

82 Hursthouse 1999, 73-5.

83 This is so even if we agree that Sophie did the right thing, and perhaps even if we think that there is a sense that she made a heroic choice. Even if we think that our everyday behavior falls morally far short of Sophie's choice, there is still a clear sense in which we don't want to be Sophie. We'd rather fall short under normal circumstances than make a heroic choice in this one. It is not clear whether this attitude is best characterized as a moral one, or one which seeks to restrict the relevance of morality. But it is clearly an evaluative one.

84 Styron 1979, 538.

85 I assume that this definition requires refinement. But this is not the place for such work.

89 Gardiner 2009.

90 Oceanographer Sallie Chisholm, quoted in Monastersky 1995.

91 Kiehl 2006, 228; emphases added.

94 Schneider 1996, 299-300.

96 Another root of tarnishing would be if geoengineering led to the infliction of marring choices on others. See above.

97 Robock 2008.

98 Consider, for example, Williams' famous examples of Jim and the Indians, and George and the chemical warfare job. Williams famously concludes that Jim should shoot the Indian. But he chastises utilitarianism for reaching the same conclusion too easily, without realizing what is at stake for Jim in such a decision. Perhaps what is at stake is a marring evil.

100 Indeed, perhaps we are pushed in this direction by the very factors (e.g., ways of life, institutions, values) that caused the mess in the first place.