Solar Radiation Management Through an Ethical Lens: Exploring Moral Permissibility of Climate Change Mitigation Through the Doctrines of Double Effect and Doing and Allowing

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Abstract

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In this thesis, I approach geoengineering from an ethical perspective, largely in regards to moral worries surrounding it. Solar Radiation Management (SRM) as a climate mitigation strategy both bolsters positive results and threatens morally unacceptable outcomes. Marine and environmental policy often dictates the livelihood and well-being of humans, animals, and environments without a formal ethical appeal to their moral consequences. In this thesis, I explore SRM via an ethical evaluation of David Morrow's "Starting a Flood to Stop a Fire? Some Moral Constraints on Solar Radiation Management." In his paper, Morrow attacks the notion that geoengineering is “not forbidden by any moral constraint,” or in other words, he hopes to manifest moral worries surrounding it. Morrow presents two widely-accepted ethical doctrines that speak to the worries surrounding SRM by raising potential moral constraints: The Doctrine of Doing and Allowing and the Doctrine of Double Effect. I present arguments in objection to Morrow’s claims raising

concerns with diaganologies and false assumptions in his paper. Ultimately, I conclude that although SRM faces many moral worries about uncertainty, risk, and field research, Morrow largely fails to highlight them using the doctrines discussed. In other words, I present major obstacles he must address before claiming that SRM faces specific moral constraints. This type of commentary sheds light upon the importance of ethical considerations in forming policies, and the complexities that call for attention in such philosophical discussions.

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DEDICATION

For my Richard Holstein, Mary Holstein, and Dan Ward.

Introduction

A. Public Policy and Ethics

Public policy processes are often interdisciplinary beasts,[1] calling upon disparate academic areas to inform regulations and laws. Birkland (2011) celebrates this characteristic, noting the benefits of drawing "upon best insights form the natural sciences, social sciences, and humanities."[2] Although the policy process eagerly turns to economics, politics, sociology, and statistics to inform decision-making, ethics are seldom formally considered. Birkland (2011) notes that moral intuitions play a natural and important role in shaping policy,[3] as any regulation with glaring ethical problems will fail to garner support from governmental institutions and the public alike. Although policy-makers might intuitively appeal to folk-ethics, a philosopher is scarcely called upon to perform a formal ethical analysis of a policy before it is implemented.

An ethical analysis, I argue, deserves crucial and early attention in the policy process. When a group or individual wields some level of power over the public and its future, this entity ought to formally understand rights, moral constraints, and ethical values that must be considered to maintain the moral permissibility of a policy. A formal ethical analysis not only acknowledges stakeholder interests, but also fully recognizes rights, moral constraints, and potential harms. Additionally, such an analysis systematically explores potential decisions via the consideration of ethical principles, whereas mere intuitions are not equipped to do so.

B. Ethics and Geoengineering

In this thesis, I perform an ethical analysis to address emerging discussions about geoengineering as a potential mitigation strategy for climate change. However, my arguments

[1] Birkland, 13.
[2] Birkland, 13.
[3] Birkland, 17.

about the moral constraints of geoengineering are only one facet of this paper. I hope one consequence of this argument is that it serves as a model for an appropriate level of ethical consideration to perform in the face of marine and environmental policy-making, especially when decision-making may impart risky or potentially harmful consequences upon certain stakeholders. Geoengineering provides a ripe example that formal ethical consideration is necessary in the policy process because of potential for severe public harms. As will become clear in the following chapters, environmental policy makers ought to include analysis from an ethical perspective to ensure potential harms and benefits have been adequately considered. The Royal Society Report (2009) calls for some philosophical guidance on geoengineering, which indicates some academic and political interest in the sorts of harms and benefits it may bring about.

C. Ethics and the School of Marine and Environmental Affairs

This sort of analysis is additionally useful to The School of Marine and Environmental Affairs itself. Dedicated to livelihoods of humans, animals, and environments, this program ought to give a hard look toward issues beyond scientific and political pursuits in understanding impacts of climate change. In other words, technology, policy, scientific, and funding constraints are not the only relevant and discussion-worthy issues that deserve consideration when facing a threatening issue. An ethical discussion is important for this department because issues surrounding harm ought to *influence* decisions in other fields through the acknowledgement of important moral constraints.

1. Geoengineering

1A. Introduction to Climate Change

Climate change, as defined by the United Nations Framework Convention on Climate Change (UNFCCC), describes the phenomenon in which long-term weather trends are altered specifically as a result of anthropogenic activity.[4] Although many abiotic factors have contributed to such changes over the climate record, current discussions exclusively tackle climate forcing mechanisms brought upon by anthropogenic means, such as greenhouse gas emissions. Such emissions contribute to long-lasting climate trends because of the greenhouse effect, a property of the earth's atmosphere. The earth's gases, especially methane and carbon dioxide, trap heat (received via the sun's solar energy) and keep the earth's surface temperatures warm enough to sustain life as humans currently know it. In other words, despite some heat energy re-released or reflected back into space, specific gases trap a portion of heat within the atmosphere that makes life livable. When carbon dioxide levels increase in the earth's atmosphere (due to fossil fuels burned for energy, transportation, and similar uses), the effect intensifies and creates an atmosphere that is abnormally warm.

Consequences of climate change are sweeping and not entirely understood. Surface temperature increases due to increased radiation energy threatens the earth's oceans, the arctic, and rainforest infrastructures. Climate and habitat changes threaten the livelihood of a myriad of species (and further, entire ecosystem frameworks). Varying climate trajectories might lead to different types of lives for future humans, but potential threats they might face include destruction of marine resources, extreme weather events, sea level rise threatening coastal communities, and habitat and vegetation changes. Possibilities of emerging tipping points and chain reactions also worry researchers modeling climate change trajectories. It is widely accepted within the scientific community that climate change will induce major alterations to the

[4] UNFCCC, 7.

human life that flourishes today. The IPCC notes that even though models cannot pinpoint exactly which changes will emerge as a result of climate change, it can be said with "high confidence" that water resources will be affected, marine species will change seasonal activities and migration patterns, crop yields will be negatively impacted, and the most vulnerable human populations will suffer the brunt of such changes.[5] In other words, climate change is a widely researched and academically-accepted phenomenon that threatens many aspects of human wellbeing that depend upon the use of natural resources.

1B. Climate Change and Mitigation Policies

In an attempt to avoid the most extreme climate scenarios in the next 100 years, policy-makers might create regulations, treaties, agreements, or statutes meant to decrease the rate of carbon emissions released into the atmosphere. Tackling carbon emission output rates that significantly contribute to climate change will likely require mitigation policies. Mitigation policy spans a broad range of practices, which might include "using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior. It can be as complex as a plan for a new city, or as a simple as improvements to a cook stove design."[6] Mitigation policies ensure widespread commitment to reducing emissions via formal governance structures.

Many climate change researchers are frustrated with the lack of prevalence of such mitigation strategies, citing that current policies are not robust enough to tackle changing global trends.[7] Concerned liberal politicians from the United States have met formidable backlash from the (conservative-majority) Legislative Branch in crafting mitigation policies—Rosencranz

[5] IPCC, 4.
[6] UNEP.
[7] Rosencranz, 225.

(2002) describes the Clinton Administration, desperate for some political dedication to mitigation strategies, scrambling to overcome a conservative legislative blockade: "all [mitigation] programs are very modestly funded because the president asked for so little and the Congress appropriated even less."[8] Congress further underfunded any sort of Executive budgetary request, even when requests merely sought to fund what Rosencranz dubs "everyday, common-sense programs."[9]

Post-Clinton, President Bush did not prioritize climate issues, repudiating the Kyoto Protocol because of perceived threats against American economic stability.[10] Paul Cruzen emphasizes sluggishness in policy development in his 2006 intervention, a now classic paper reopening the debate about geoengineering, noting that although mitigation strategies combating emissions outputs are the obvious and right path for policy-makers to strive for, efforts are "grossly unsuccessful."[11]

The United States is not the only country struggling in regards to mitigation policies—global cooperation has similarly floundered. Hamilton (2014) notes that "for those who grasped the enormity of what was at stake [in regards to impending climate consequences,] the remnant forces of hope for international action were gathered together for one last mighty push at the [UNCCC] Copenhagen conference in 2009. The collapse of the talks left an abyss of despair for the future of the world…[However,] while governments have been dragging their feet…there has been no shortage of enthusiasm to open up new sources of fossil energy."[12] Despite some more notable policy progress within the EU and interest to make genuine efforts to tackle climate issues, large and industrious developing countries, like China and India, do not necessarily show

[8] Rosencranz, 225.
[9] Rosencranz, 225.
[10] Rosencranz, 227.
[11] Hamilton, 158.
[12] Hamilton, 9.

a level of dedication to mitigation policies necessary to curb warming trends. Further, countries like Russia, whose economy hinges largely upon the fossil fuel industry, may find it harder to part with their current successes in the name of future benefits.

1C. Geoengineering: A Potential Answer?

Geoengineering is a technology-based strategy against climate change threats. The Royal Society (2009) defines geoengineering as "a deliberate large-scale intervention in the Earth's climate system [implemented] in order to moderate global warming."[13] —some strategies call for literal removal of carbon from the atmosphere via artificial capture, some attempt to block out the sun's energy via global dimming with stratospheric sulfate aerosols projected into the atmosphere, and some seek to create high-albedo marine clouds that will re-reflect solar energy into space.

Some types of geoengineering are referred to as Solar Radiation Management (SRM), which refers to "a form of climate engineering [that] would offset the effects of increased greenhouse gas concentrations by reducing the amount of sunlight absorbed by the Earth."[14] In other words, geoengineering and SRM are man-made efforts to intervene with atmospheric and climate changes in order to dampen the warming effects of projected trends. With varying forms of geoengineering come varying efficacies, moral constraints, and potential risks. I focus on stratospheric sulfate injection (SSI) as an important example in this thesis, but these discussions might be applied to other varieties as well.

Geoengineering as an entity is still young and currently not near ready for responsible large-scale implementation. Modeling and limited research are currently the only sources to

[13] The Royal Society, ix.
[14] Morrow, 123.

inform different types of SRM and their potential efficacy; no geoengineering efforts have yet been formally implemented. Some researchers are increasingly enthusiastic to commence small-scale field experiments because geoengineering might serve as an emergency measure to curb climate change effects if other mitigation efforts continue to flounder.[15] Although geoengineering's aim is to reduce the damaging effects of climate change, it might pose threats to specific populations and raises some environmental justice worries. Geoengineering's consequences are not entirely known given its fledgling status, but engineering anthropogenic climate alterations is thought to be a likely vehicle of unexpected changes in the earth's ecosystems. For instance, humans cannot know how increased rainfall, decreased daylight, or air pollution might affect vegetation, habitat, animal life, storms, or seasons. Some predictions are so extreme as to suggest that some mechanisms of SRM (i.e. marine cloud brightening) might lead to dire precipitation loss in the Amazon or in India. Hamilton (2014) adds a concerning note that studies indicate "some poor countries may suffer harms from some climate engineering techniques [the most]."[16] These types of threats not only raise concerns about harm, but of non-equitable climate solutions.

1D. Geoengineering and Ethical Questions

In this thesis, I approach geoengineering from an ethical perspective, largely in regards to moral worries that potentially surround it. SRM both bolsters positive results and threatens morally unacceptable outcomes. Marine and environmental policy often dictates the livelihood and well-being of humans, animals, and environments without a formal ethical appeal to their moral consequences. In this thesis, I explore specific aspects of the permissibility of

[15] Morrow, 123.
[16] Hamilton, 165.

geoengineering for two reasons. First, geoengineering research and implementation is in a ripe state for philosophical influence. While many environmental policies are extensively tested in regions all over the world, geoengineering's fledgling status provides an exciting canvas for thorough ethical consideration. As Morrow explains, "policy makers do not yet need to decide whether to deploy [geoengineering], but they do need to decide whether to support [geoengineering] research. The wisdom of supporting [geoengineering] research depends partly on whether it could ever be morally permissible to use [geoengineering] as a form of climate engineering."[17] In other words, geoengineering is still young enough for a philosophical analysis to be genuinely significant in influencing its research, field experiments, and the extent to which it is eventually implemented (if at all). Second, as mentioned at the beginning, this discussion is meant to be an example for other policy makers to use ethical frameworks in contributing to environmental and marine decisions.

This thesis will specifically address concerns raised in David Morrow's "Starting a Flood to Stop a Fire? Some Moral Constraints on Solar Radiation Management." In his paper, Morrow attacks the notion that geoengineering is "not forbidden by any moral constraint,"[18] given human-induced climate change with negative effects that is already taking place. Before discussing his argument, it is important to note that in order to be charitable to Morrow, I will not literally interpret his worries as damning factors that render geoengineering entirely "impermissible" or "forbidden." It would be needlessly heavy-handed (and further, problematic) to claim that a single moral constraint is sufficient in rendering an activity, especially one that offers climate benefits, automatically prohibited. Verbiage aside, Morrow is otherwise clear that his intent is not so extreme—he merely hopes to make a defeasibility argument. Parts of

[17] Morrow, 123.
[18] Morrow, 128.

Morrow's conclusion might hint to his restrained intentions: for instance, he notes that "critics of SRM may find this paper's conclusion surprisingly moderate"[19] and that "for various reasons, [applying policies based upon moral constraints] is not so simple."[20] In other words, Morrow's presentation of moral constraints is not meant to definitively destroy the permissibility of SRM, but to manifest important moral considerations that make it harder to justify.

In order to cast some doubt surrounding SRM, Morrow presents two widely-accepted ethical doctrines to manifest moral constraints: The Doctrine of Doing and Allowing and the Doctrine of Double Effect. In this thesis, I present arguments in objection to Morrow's claims; I maintain that Doing and Allowing and Double Effect *do not* necessarily speak to moral constraints of geoengineering because Morrow's claims hinge upon false assumptions. First, Morrow claims that Doing and Allowing highlights a moral constraint on SRM because actively imparting harm by manually engineering the climate is ethically worse than merely allowing it to happen via passive emissions production. This evaluation of Doing and Allowing hinges upon an analogy that does not relevantly align to the climate change scenario at hand—Morrow neglects to consider an important third option, low-risk mitigation policies.

Second, Morrow's evaluation of Double Effect similarly falters, in that he claims that geoengineering represents concerted intentions to change the climate, while use of fossil fuels produces foreseeable but unintended climate consequences. This argument depends upon a false assumption that when considering emissions contributions to the earth's atmosphere, one should primarily consider the intentions of individuals. Their lack of agency and funding to live emissions-free lifestyles indicates that players of power (e.g. governments, oil companies) should be considered instead. When such a consideration is made, climate change is similarly

[19] Morrow, 135.
[20] Morrow, 136.

implicated as suffering a moral constraint. Ultimately, my claim is that Morrow's arguments do not challenge the permissibility of geoengineering.

A third, general, concern relates to Morrow's use of the term "Responsible SRM." This term is unproductive in having genuinely useful discussions about SSI and moral worries. Although tight and useful for the Risk Profile* argument to come, it fails to capture a genuine picture of what SRM actually looks like and how it might apply to our world.

This process is meant to cast doubt upon Morrow's claims regarding moral constraints and worries surrounding SRM. If this discussion does not entirely derail Morrow's analogy, I have at least highlighted that there is reason for pessimism that Morrow is seriously incomplete in his discussion. I have imposed a major burden of proof for Morrow to address concerns that promise to derail his analogy and argument unless he clarifies and amends it.

Finally, I intend to highlight the complexity of geoengineering ethics and its well-deserved qualification for consideration in climate change mitigation policies to come. Denying the validity of Morrow's arguments is a narrow task, as his objective is modest in the first place; he merely hopes to note that philosophical principles may highlight some moral constraints of geoengineering that deserve attention. Of course, no reader should accept my arguments as moral justification for geoengineering implementation, as research, risk-assessment, funding, and technological worries must necessarily be addressed. In other words, one certainly should not accept this discussion as adequate coverage of the many environmental justice issues that must be addressed before morally acceptable implementation. Further, just because Morrow's arguments, as they are, do not adequately highlight moral constraints of geoengineering does not mean no other constraints exist. It is even possible that these very principles, when used differently, may effectively manifest moral constraints or the impermissibility of SRM. Many

questions about SRM remain, and will require a robust collection of literature and philosophical discussion to tackle. This argument, however, might shed light upon the importance of ethical considerations in forming policies, and the complexities that call for attention in such philosophical discussions.

Chapter 2: Risk Profile*

In this chapter, I present the framework Morrow uses to discuss two major claims in his paper.[21] Morrow makes an argument that there might be important moral worrie surrounding SRM because of moral constraints that are manifested through Doing and Allowing and Double Effect. He frames this idea using an argument called "Risk Profile*." Risk Profile* is inspired by the common sentiment that, "in conversation, scientists who study SRM sometimes say, 'we are already changing the climate. What could be wrong with changing it deliberately in order to reduce the risks of climate change?'" (Morrow, 124). Intuitively, this sort of reasoning might be attractive; the following argument is Morrow's formal articulation of this sentiment.

> *RISK PROFILE**
> *(1) Humanity is knowingly changing the Earth's climate for the worse in the sense that humans know that their GHG emissions are making humanity's risk profile significantly worse than it would otherwise be.*
> *(2) 'Responsible SRM' is defined as any form of SRM that is believed with very high confidence to yield a better risk profile than any reasonably expected non-engineered climate state.*
> *(3) When humanity is facing great risk, an action that improves humanity's risk profile is morally permissible, provided (a) there is no feasible alternative that would improve humanity's risk profile even more, and (b) the action is not forbidden by any moral constraints.*
> *(4) Responsible SRM would not be forbidden by any moral constraints.*

[21] Although Morrow's objection is a deontological one, its results still might be attractive to a consequentialist. On 127, Morrow notes that "given that the majority of philosophers—including many consequentialists—agree that morality includes constraints of some type, and that moral constraints enter into most people's day-to-day moral thinking," his reasoning might be attractive to various groups of philosophers regardless of their "ethical camps."

(5) Responsible SRM, if it is possible, would be morally permissible when it improves humanity's risk profile more than feasible mitigation and adaptation measures would.[22]

Morrow objects to the (pro-SRM) Risk Profile* argument through its 4th premise, that responsible SRM would not be forbidden by any moral constraints. In other words, he claims that SRM could indeed violate at least one moral constraint, and appeals to the doctrines of Doing and Allowing and Double Effect to justify this claim. Such a moral constraint would represent increased ethical concern one should have about SRM. In the following chapters, I address and object to both of his arguments in-depth.

Chapter 3: The Doctrine of Doing and Allowing

3A: "Responsible SRM"

Before presenting objections, I highlight a more general problem that hinders both the Risk Profile* argument and following replies—Morrow's introduction of Responsible SRM. Recall from Risk Profile* Premise 2 that this term describes "any form of SRM that is believed with very high confidence to yield a better risk profile than any reasonably expected non-engineered climate state."[23] Although Responsible SRM is tight and useful for the sake of the Risk Profile* argument, it is not useful for a genuine evaluation of the permissibility of SSI or any other form of geoengineering. The entire discussion is hindered by considerations of Responsible SRM and the major issues attached to its definition. This term is problematic because a) it likely is not applicable to our world given temporal and political restrictions, and b) merely boasting the best risk profile does not necessarily indicate its risk profile is morally acceptable.

3B: Responsible SRM's Application to Our World

[22] Morrow, 124.
[23] Morrow, 124.

The worry in regards to a) is two-pronged: first, Morrow does not adequately discuss mitigation policies in describing Responsible SRM, and second, he does not consider that the Responsible SRM he describes is likely unattainable.

Although puzzling, the first worry is not a major threat to Morrow's argument. I discuss it here because mitigation policies ought to be mentioned when discussing SRM and their absence in this argument seems like a glaring gap. It is widely accepted that in order to be sustainable, effective, and terminable, geoengineering must be performed in conjunction with carbon emissions mitigation policies.[24] In order to achieve the Responsible SRM that Morrow discusses, this sort of emissions mitigation is necessary—yet he still fails to acknowledge it as a factor. Concurrent mitigation policies must be established in order to achieve Responsible SRM because any geoengineering attempt without them is merely a short-lived carbon cover-up.

In order to be charitable to Morrow, I will interpret the term Responsible SRM" as a strategy that concurrently implements SRM and other complementary mitigation policies (e.g. stricter limitations on emissions, use of clean energy sources, etc.). Despite an absence of their mention in his paper, this is the only coherent interpretation possible since implementation without complementary policies will definitively prove unsuccessful. This interpretation mirrors sentiments of the "Shave Off the Top" argument, which posits that when complemented with mitigation policies, "some geoengineering measures appear to offer humanity the ability to shave the peaks off CO2 driven emissions and avoid tipping points."[25] In other words, given SRM (in conjunction with mitigation policies) has the ability to shave off the worst effects of carbon emissions, it may be able to confer a benefit beyond those of mere mitigation cannot. Under this interpretation, Morrow dodges my first worry.

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[24] Keith, 164.
[25] Rayner et al., 8.

My second worry, regarding Responsible SRM's attainability in our world, is more serious. Responsible SRM is only useful if it is achievable in the actual world given temporal and political constraints. It is not valuable to assume away SRM's gravest moral concern (risks upon implementation) in order to create an argument for or against geoengineering. Of course, it is possible to imagine some possible world in which this type of SRM could be achieved, but determining this strategy's permissibility in *this world* requires a discussion of the actual state of SRM. Many uncertainties cast doubt upon the attainability of Responsible SRM's application in this world. For example, SSI is only a useful pursuit if its implementation is timely—if it takes another 100 years for its establishment, its utility will not provide substantial climate benefits.[26] SSI also faces political constraints: given its fledgling status, it is not particularly well known and motivation to test via small-scale field experiments is low.[27] Research and technology uncertainties provide even more blockades of implementation (not to mention *effective* implementation, which is necessary for Responsible SRM's "best risk profile"). Even if implementation were timely, it would not come without grave risks of harm lingering given lack of knowledge through best available science. Given these concerns, it is highly unlikely that Responsible SRM's best risk profile is achievable.

Moving forward, I instead consider the least-risky implementation strategy of SRM (i.e. in conjunction with mitigation policies) in order to determine whether it is less risky than mitigation alone. Although I could technically compare mere mitigation to some non-existent form of SRM without all of its risk, but that exercise loses all utility in the broader discussion of SRM's moral constraints.

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[26] Keith, 4.
[27] Hale (2012).

3C: Responsible SRM: Not Good Enough?

The worry in regards to b) concerns a scenario in which SRM boasts the best risk profile, but is still so harmful that it is clearly impermissible. In other words, a term like "Responsible SRM" might be somewhat of a misnomer, because although Responsible SRM promises risks lower than that of those incurred by not implementing it, its risks still may not be "low." Responsible SRM might actually be *extremely risky*—and place climate burdens upon populations that would not otherwise deal with them—despite technically being lower risk than another high-risk alternative. Settling for the least risky option amongst unacceptably risky options is not necessarily a permissible pursuit. For example, if you are choosing to either push someone off a 100 story building or to push her off a 200 story building, the first option technically boasts a lower risk, but neither plan seems permissible or worthy of implementation.

As I present the following objections, these Responsible SRM issues will reemerge. Although this term presents the general issues discussed above, it even further imposes difficulties for Morrow and efforts to reply to my objections.

3D: Doing and Allowing

Morrow argues that Solar Radiation Management (SRM) is morally impermissible because it violates moral constraints. In justifying this violation, Morrow draws an analogy relating to Doing and Allowing, claiming that SRM is worse than non-intervention because it is an initiation of a threatening sequence. I present two objections meant to illuminate that SRM and classic Doing and Allowing situations are not analogous: first, there is a preferable third option (carbon emissions mitigation) in climate change decision-making that he fails to

acknowledge. Second: although SRM threatens the possibility of harm, classic Doing and Allowing examples discuss harms that are *guaranteed to occur*, and I argue that this distinction should at least be considered. In other words, I claim that Morrow's objections to the fourth premise of the pro-SRM Risk Profile* argument fail to weaken it given the disanalogy.

As discussed in the previous chapter, Morrow claims that SRM could violate at least one moral constraint, and appeals to the Doctrine of Doing and Allowing to justify this claim. His argument might be organized into three premises, the first being that violating Doing and Allowing violates a moral constraint. Morrow defines the Doctrine of Doing and Allowing as follows:

> *It is morally worse for an agent A to bring about some harm H than it is for A merely to allow H to occur, where:*
> *(i) A 'brings about H 'if A is part of the causal sequence leading to H, either because A initiates that sequence or because A sustains it; and (ii) A 'merely allows H to occur' if H results from a sequence that A allows or enables to continue, but neither initiates nor sustains* (Morrow, 129).[28]

In other words, actively harming someone (or helping to sustain active harm) and merely practicing inaction and allowing harm to occur seem morally distinct. If no distinction between doing and allowing were made, morality would be "far too demanding."[29],[30] This is exemplified with a story about a fire: imagine a wildfire is threatening a large city. The government can either choose to let it run, destroying the edges of the city, or to open the floodgates of a dam to stop it, destroying a small town in the flood's path: "the Doctrine of Doing and Allowing entails

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[28] By Morrow's account, "sustaining" harm equates to "doing," while "enabling" harm equates to "allowing." This distinction might not be intuitive, so I will briefly summarize it. To sustain a fire, according to Morrow, is not to light it, but to contribute to its sustained existence, perhaps by throwing lighter fluid on it. To enable a fire would be merely to acknowledge and fail to extinguish it. Morrow's full explanation can be found on 129.

[29] Morrow, 130.

[30] Morrow notes that the scope of his paper is too narrow to formally justify Doing and Allowing and Double Effect as valid principles in themselves. Similarly, I will only discuss their relevance and usefulness in regards to the Risk Profile* argument.

that the damage averted would have to be very large to justify the moral wrong of destroying the homes near the dam."[31] This is because doing (releasing the flood) and allowing (merely allowing the fire continue to burn) are morally distinct. Morrow claims that the moral constraint of harming others more stringently applies to actually imparting it (i.e. "doing") than merely allowing harm to occur without an active role in conferring it (i.e. "allowing").[32]

Second, Morrow claims that SRM violates a moral constraint via actively doing something potentially harmful, as opposed to *allowing* harm to happen via uninterrupted climate change. To illustrate this point, Morrow creates an analogy that is quite important to his argument. He claims that geoengineering is analogous to opening the floodgates and refraining is analogous to allowing climate change to run its course. Although it may seem like both instances are that of "doing" (actively contributing to climate change via emissions and actively seeking to avoid it by implementing new technology), Morrow argues that contributing to climate change is more accurately categorized as "allowing." He explains that "once the fire starts, the homes in the city are threatened; the homes in the [dam] town are not. Thus, if the government does nothing, and the homes in the city burn, the government has merely allowed a harmful sequence to continue. If the government releases the floodwaters, however, they have initiated a new sequence that harms the town. Doing and Allowing therefore counts starting the flood as worse than allowing the fire to burn, other things being equal."[33]

Allowing climate change to continue, he claims, is analogous to the case of allowing the fire to continue: something bad is already occurring. The government (or at least the current, decision-making government) did not spark the trend of fossil fuel usage as it currently stands: this pattern is merely a bad thing that they are allowing to continue. Actively beginning a

[31] Morrow, 129.
[32] Morrow, 129.
[33] Morrow, 131.

process of geoengineering, however, *would* qualify as "doing:" a new process is initiated, one that Morrow qualifies as "threatening."[34] Or in Morrow's words: "governments initiating SRM would be endangering one set of persons, animals, etc. to decrease the risks faced by another set of persons, animals, etc."[35] Because SRM is a threatening sequence that the government (or governments) would literally initiate, it is analogous to "doing," which is more morally problematic than merely allowing climate change to run its course.[36]

In conclusion, Morrow claims that SRM violates a moral constraint. If actively imparting harm is a moral constraint, and geoengineering qualifies as an active induction of harm, geoengineering will face trouble in the Risk Profile* argument. In other words, SRM's moral permissibility is called into question given this type of harm.

3E: Objection 1: A Preferable Third Option

Next, I present two objections meant to cast doubt upon Morrow's claims that hinder the Risk Profile*'s argument by attacking Premise 4. My first objection addresses Morrow's claim that geoengineering violates Doing and Allowing. As previously explained, Morrow argues that geoengineering is worse than mere climate change, and uses an analogy to support this claim. In this objection, I argue that the "geoengineering vs. climate change" situation is *not* analogous to the fire example or other similar Doing and Allowing situations.

One famous Doing and Allowing situation I will also reference is that of the trolley. In the trolley example, an innocent bystander is faced with a choice: she sees an out-of-control

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[34] Morrow, 131.
[35] Morrow, 131.
[36] One could potentially object to Morrow in regards to this reasoning. Although the current government did not initiate harmful fossil-fuel trends, they do sustain their market successes by conferring noteworthy subsidies. This note seems important to touch upon because I have dedicated this paper to ways in which the fire and flood example is disanaolous to the climate change situation at hand. This is another way in which the two stories do not align, and this affects the judgment that emissions patterns qualify as "allowing."

trolley hurdling toward five people in the tracks. She is standing by a switch that has the power to change the trolley's trajectory by switching it to a track in which only one person would be victimized. Assuming she cannot call out to any of the potential victims, the person is faced with a choice of either inaction (killing 5) or action (killing 1).

In such situations there are only two possible choices: a third, more-preferable choice would be better than the existing two by definition. In the trolley example, one is faced with the choice of either inaction (killing 5) or action (killing 1); in the fire example, one is similarly given two options: inaction (allowing the fire to burn, damaging the outer-city) or action (destroying the town near the dam). Doing and Allowing merely claims that doing is *worse* than allowing, but if there were a third choice in which harm could be circumvented, that seems to be the preferable option. The Doctrine does not speak to this option, because it is based upon a binary situation in which some degree of harm cannot be avoided, but given a third choice is the least harmful, it is intuitively the best one. Imagine that a third option in the trolley case would be to tell the people to move off the track, or imagine that a third option in the fire case would be to send out a plane to dump water on the fire. This third choice is *obviously* the best option.

In the story of SRM, such a third choice exists: mitigation policies against climate change. The SRM story cannot be likened to those of the fire and the trolley because decision-makers are not faced with only two choices, both of which are harmful to varying degrees: instead, there are several mitigation options that are objectively less harmful than either letting climate change continue uninterrupted or SRM.[37] It is puzzling that Morrow ignores this third option when making the comparison, because it destroys the legitimacy of the analogy altogether. Because it is Morrow's main justification for SRM's moral gravity, his argument

[37] Some effective examples of climate change mitigation polices that could be more widely implemented include cap and trade, emissions reductions, or incentives to explore renewable energies.

against Premise 4 is not particularly strong. In other words, it seems strange to argue that "allowing" climate change is the better option, when an even better option goes unacknowledged: climate change mitigation strategy. Further, one could argue that there are combinations of mitigation and carbon dioxide removal that also boast promising risk profiles—I discuss this later. The preferable third alternative destroys any special privilege of imparted harm allowed in a desperate, Doing and Allowing situation.

3F: Replying to Objection 1:

Stephen Gardiner posits a clever reply on Morrow's behalf. This reply suggests that the objection's "preferable third option" does not exist, because mitigation policies are not better than Responsible SRM. If this is true, his Doing and Allowing argument might still hold. He suggests that Morrow's second premise in the Risk Profile* argument protects against discussions of intuitively-beneficial mitigation policies by defining Responsible SRM as something that will "yield a better risk profile than any reasonably expected non-engineered climate state."[38] He claims that Responsible SRM would be, by definition, better (risk-wise) than a non-engineered climate state in which SRM is not conducted, but fossil fuel mitigation policies are put into place (supposedly because of climate benefits SRM could bestow upon the world). This way, Morrow can claim that Responsible SRM boasts the best risk profile (i.e. suggesting that the third option of mitigation policy is not actually preferable, protecting against my objection), but still falls prey to the moral constraint highlighted in previous paragraphs.

Morrow cannot lean on this reply because of previously discussed issues relating to Responsible SRM's attainability. The reason Morrow might argue that implementing both SRM

[38] Morrow, 124.

and mitigation policies concurrently is the option with the best risk profile is because, climate-wise, it presents favorable climate outcomes. Not only is emissions pollution diminished, but through technological means, humans might cut back the negative effects of pollution already present.

This interpretation of the "best risk profile" neglects to acknowledge the grave, notable, and not-entirely-understood risks inherent in implementing SSI at all, even in conjunction with mitigation policies. In other words, *any* strategy that leans upon SSI automatically accepts an array of risks that might severely harm (or re-attribute harm to) certain parts of the world. For example, while SSI might reduce the earth's surface temperature by half a degree (which might be considered a benefit through environmental risk reduction), it also might destroy farming practices in Southern Asia via lost precipitation, pose grave public health risks through air pollution, adversely affect ocean ecosystems that depend upon sunlight, and more.[39],[40] Such a strategy cannot possess the "best risk profile" in this world; Morrow's claim fails to consider the significant uncertainties that go hand-in-hand with this strategy, even when it is implemented in conjunction with mitigation policies.[41] Responsible SRM's tight definition seeks to exclude these risks, but such a version of SRM is unlikely attainable in this world given current uncertainties.

This reply does not necessarily put the nail in Morrow's coffin. Admittedly, it could be argued that it is possible for SRM's evasion of an extremely grave tipping point to garner the

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[39] Keith, 115.
[40] Rayner et al., 8.
[41] I would like to preemptively cover by bases in regards to my second objection to come. As you will soon see, my second objection claims that SRM is not necessarily risky, but we are quite uncertain of its risks. That claim might seem to be at odds with my discussion here, which dings Morrow for failure to consider *possibly* grave risks of SRM. I do not hope for this to be the case—when crafting a risk profile when not all risks are known, uncertainties should be considered as risks in themselves to best understand the overarching threats of SRM. However, when merely discussing the riskiness of SRM, risks and uncertainties can be differentiated (which is useful for my second objection.)

best risk profile despite a lot of harm imparted in order to achieve it. Even so, Morrow is still confronted with issues surrounding this argument. If the harm of SRM is particularly severe or horrifying, one might question if discussion of the "best risk profile" is the only type of consideration that should be made in determining the permissibility or plausibility of geonegineering implementation (regardless of climate benefits). Recall that, given my objection, Morrow and I are respectively claiming that Responsible SRM and mitigation policies are the most "preferable" options—it seems narrow to purport that the only factor in determining the superior choice is that option's riskiness. Riskiness is only one consideration amongst many, including redistribution of harms, benefits conferred, equity, severity of harms imparted, etc. Further, it is unclear whether the determination of the "best risk profile" is adequate justification for a very harmful action when even the best risk profile is very risky and does not eliminate the threats of egregious harms, as noted previously.

3G: Objection 1: Some Concluding Remarks

Overall, I argue that Morrow ought to be mindful of and account for a third, preferable option in structuring his analogy because mitigation via policy decisions, at the present time, has a better risk profile than a strategy with SRM. Although conceptually attractive, a responsible version of SRM without its risks is only a pipedream given current uncertainties and should not be used to lead a discussion about moral constraints of SSI. Instead, I am considering the least risky form of SSI—one implemented with complementary mitigation policies. SRM's climate benefits, i.e. reduced risk it provides by hindering warming effects, do not compare to the monumental risks posed by its very implementation. Mitigation policy, however, has the capacity to be highly effective and extremely low risk. If a monumental overhaul of emissions

via policy decisions were phased-in in the coming years—certainly a more plausible task than SSI implementation—the unsettling climate trajectory of the world would surely improve. This decreased risk would not come at the costs of huge additional risks incurred (like those inherent in SRM).

Morrow might find some help in preserving the legitimacy of his Doing and Allowing worries by considering that geoengineering might evade tipping points that mere policies cannot. However, I have at least provided some major worries he must address if he hopes to confidently purport the fire analogy in highlighting a moral constraint. Before accepting that sort of statement without problems, Morrow ought to address obstacles like answering how risky the best risk profile might be, whether the best risk profile is a sufficient justification for an action to be considered "preferable," and whether he's adequately considered a policy avenue in his analogy that does not face SRM's worries.

3H: Objection 2: Differentiating Threat from Definitive Harm

My second objection to Morrow's claim critically considers his description of SRM as "threatening." Assume, for a moment, that SRM can be likened to "doing." Morrow claims that geoengineering is morally worse than merely allowing climate change because "governments initiating SRM would be endangering one set of persons, animals, etc. to decrease the risks faced by another set of persons, animals, etc." Morrow describes SRM as a "threatening" activity, much like that of releasing the flood onto the fire. The SRM story and flood story are not analogous once again, but in a different way. In the flood story, action definitively damages the dam-town, and in the trolley story, pulling the lever definitively harms or kills someone standing

on the tracks. In the SRM story, however, there is merely a threat against specific populations: unlike a flood or trolley, SRM does not necessarily impose harm on others.

If an initiated activity is *highly* threatening, its threats might be considered similarly to ensured harms. However, the Risk Profile* argument specifically addresses "responsible SRM," which, by definition, presents lower risks than in non-intervention scenarios. Given that SRM does not pose certain damage like that of other Doing and Allowing examples, it does not seem reasonable for Morrow to so strongly consider SRM's risks when any action is accompanied by risks that are regularly ignored. Some every day tasks might present monumental risks to oneself and others (e.g. driving, flying, drinking), but their risks certainly are not considered reason to halt the activity. Overall, the mere threat of harm that may spring from SRM does not analogously equate to the ensured harms of traditional Doing and Allowing examples.

3I: Replying to Objection 2:

Morrow might depend upon the responsibility misnomer discussed earlier in defending his claim. Recall that Responsible SRM's possession of the best risk profile does not ensure that its risks are acceptable. If SRM's risks are quite high, even their threat should be considered similarly to that of ensured harms in classic Doing and Allowing situations. To portray the high-risk scenario at hand, the SRM situation might be likened to the following example: imagine you are at a lake, sitting on a friend's speedboat that you hardly know how to operate. From your position by the dock, you notice a child is drowning in the middle of the lake, and does not have a lot of time left. You have two options: to allow her to continue drowning (allowing), or to rescue her (doing). Rescuing her, however, is risky: the lake is busy, and you are unsure if you can successfully dodge other swimming children and avoid hurting or killing them. You are

further unsure if you can make it to the drowning child in time even if successfully evading other swimmers.[42] Because you run a high and serious risk of actively imparting harm in this example, it highlights reasons why this sort of decision might be considered similarly to that of an ensured harm.

I concede that not a lot is known about SRM and its risks at the current time, but such a notion additionally allows my objection not to be entirely stricken by Morrow's reply. Morrow's reply hinges upon the assumption that SRM is a high-risk activity, but I argue that humans today are merely *uncertain* about the extent of its risks. In economics, "risk" refers to actions in which we do not know the outcome, but can calculate accurate odds that it will occur. For example, if you bet 100 dollars that a coin will land on "heads," you do not know what the outcome will be, but you are able to understand the risk you are taking via probability. "Uncertainty," however, refers to actions where there is not enough information to even calculate odds. I argue that SRM is not necessarily high risk—instead, we are *highly uncertain* of its risks. Although some speak to major threats about climate catastrophes that may stem from SRM, others are doubtful these things will happen.[43] Although geoengineering's implementation may pose serious risks, there is still a lot scientists must discover via field experiments to understand how high risks might be, and how different combinations of different geoengineering techniques might be least risky.

3J: Objection 2: Some Concluding Remarks

Given present uncertainties, Morrow should suspend his analogy until more is known, or at least acknowledge that his analogy might fall flat as research continues. What are currently interpreted as risks of SRM are largely uncertainties about how it will affect the world and how it

[42] Analogy created by Stephen Gardiner on December 1, 2015.
[43] Keith, 118.

might be improved to pose the least risk. Of course, neither Morrow nor I can properly speak to the true risks of SSI given uncertainties about its efficacy and unknowns surrounding the harms and benefits it might impart. Morrow should be mindful, however, that such uncertainty provides his argument with an obstacle that ought to be addressed. Morrow cannot liken SRM to opening the floodgates unless he adequately recognizes that its risks could be too low for that analogy to work.

3K: Doing and Allowing Concluding Remarks

Overall, I claim that Morrow's objections to the pro-SRM Risk Profile* argument do not do an adequate job in weakening it using Doing and Allowing. Morrow admits that his aims in objecting are modest, despite some confusing terminology: he hopes to highlight moral constraints of SRM that might indicate that its benefits conferred would have to be quite high to justify harms imparted. Worries surrounding the SRM scenario's disanology to Doing and Allowing situations highlight pressing problems with his argument. Even if my objections regarding a preferable third option and the mere threat of risks do not entirely topple Morrow's claims, they at least provide him with major obstacles and a burden of proof that must be addressed before being able to comfortably and soundly defend that Doing and Allowing highlights a moral constraint of SRM.

4: The Doctrine of Double Effect

4A: Moral Constraints and Double Effect

In this thesis, my aim is to object to Morrow's claim addressing SRM and the Doctrine of Double Effect. Recall that the goal of Morrow's paper is to highlight potential moral constraints that could raise serious concerns about SRM given the Risk Profile*'s argument. Morrow claims that Double Effect, when complemented with the "closeness thesis," manifests a moral constraint of geoengineering that does

not apply to climate change. In other words, he claims that although geoengineering proponents do not wish to *intentionally impart* harm via their climate engineering practices, this similar intent qualifies such potential harms as more than merely foreseen. This classification, Morrow argues, presents a moral constraint of SRM. In objection, I argue that Morrow wrongly assumes that the intentions of individual polluters should be considered when determining moral constraints of climate change—instead, one ought to consider the intentions of powerful industries and politicians that dictate standards and production of fossil fuels. When approached from this angle, Double Effect (enhanced by the closeness thesis) incriminates climate change to the same degree of geoengineering for a moral worry. In other words, major players in the oil industry do not merely foresee climate change as an unfortunate consequence of their actions, but as a *means* to achieve a profitable end. Because such environmental exploitation is a necessary condition for their gains, climate change qualifies as adequately close to intentional.

Before beginning, I briefly overview Double Effect's definition. This theory states that an action is permissible, even if it causes serious harm, if the harm is merely a side effect of promoting some good end. In other words, in determining permissibility, Double Effect "invokes the difference between doing something intentionally and bringing it about as an unintended but foreseen side effect."[44] A famous example that might exemplify Double Effect is that of the previously-referenced trolley: imagine a trolley car is speeding out of control toward five to-be victims. Standing a distance away, you have the power to direct the trolley onto another track by pulling a lever, but changing its direction will lead it to a track in which one person will be killed who otherwise would not be in harm's way. Double Effect justifies the permissibility of pulling the lever, because the trolley's new direction is not an intentional attack on the new victim, but a means to save others (with an unfortunate, but known, side effect).[45] If one changed the trolley's tracks merely to attack the new victim, the action would be deemed impermissible.

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[44] Morrow, 131.

[45] This might be further justified with a second example. While it is common for readers to deem the lever case intuitively permissible, many are weary of a different scenario with a similar outcome: it seems *im*permissible to push an innocent bystander onto the tracks in order to stop the trolley from hitting five

Morrow claims that Double Effect alone is not sufficient to make any sort of comment about geoengineering *or* climate change. Although geoengineering is thought to be an intentional activity toward climate change while, say, burning fossil fuels is not, neither intend the risky consequences that would qualify them for moral worries in the first place.[46] In other words, environmental degradation that may result from the use of fossil fuels or geoengineering is intended by neither practice: burning fossil fuels merely intends to create various forms of power, while geoengineering merely intends to improve threatening elements of climate change. Neither climate change nor geoengineering seem to specifically intend the harm they impart, so Double Effect alone is not relevant to this discussion.

4B: Closeness Thesis

Morrow does claim, however, that Double Effect, when complemented with the closeness thesis, may highlight a moral constraint of geoengineering that does not apply to climate change. If this is true, climate change may be unquestioningly permissible while geoengineering faces moral worries. Before discussing the validity of this argument, I present Morrow's description of the closeness thesis. Morrow explains that "roughly, the closeness thesis says that when a foreseen but unintended consequence is too 'close' to the intended consequences of an action, Double Effect should count it as an intended consequence."[47] Morrow illustrates this concept with an example created by Phillipa Foot: "some spelunkers are rushing to escape from a rapidly flooding cave. While wriggling through the cave's only exit, the fattest spelunker gets stuck, trapping the others inside. The remaining spelunkers have only a few minutes before the rising water drowns them all, and their only way to escape involves dynamiting the exit and killing the fat spelunker. If it would be wrong for the spelunkers to blow their fat companion to bits as a means to opening the exit…it would be equally wrong for them to kill the fat spelunker by dynamiting open a new exit immediately beside the one in which he is wedged. The fat spelunker's death is too obvious and immediate a consequence of the latter plan for it to count as a foreseen but unintended

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others. This distinction is captured by Double Effect's notion that a mere negative side effect seems morally passable to achieve some greater good, whereas active and intentional harm is not.

[46] Morrow, 133.

[47] Morrow, 133.

side effect."[48] In other words, the closeness thesis protects against actions that might not technically intend to impart unfortunate consequences, but are too closely related to such intentions to ignore the moral worry.

Given his consideration of the closeness thesis, Morrow claims that Double Effect*[49] may uncover a moral constraint of geoengineering, but not climate change. The intention of burning fossil fuels to create power is pretty distantly related to the unfortunate consequences of climate change. SRM's intention of intentionally engineering the climate is, comparably, not far from unfortunate climate side effects.[50] Given this comparison, Double Effect* may highlight a moral constraint of geoengineering that does not apply to climate change. This would be enough to flag it for notable moral constraints under the Risk Profile* argument presented earlier in this paper.[51]

4C: Morrow's Argument

In order to track my replies and objections, I present Morrow's argument via a set of premises. The argument might be formatted like this:

> **Premise 1:** "Other things being equal, it is morally worse to bring about a bad state of affairs as an intended effect of one's action or *an effect that is sufficiently 'close to' an intended effect* than it would be to bring about that same state of affairs as a foreseen but unintended side effect of an action."[52]

[48] Morrow, 134.
[49] This notation will indicate discussion of Double Effect with consideration to the closeness thesis, and was introduced by Morrow on page 134.
[50] Morrow, 134.
[51] It should be noted that Morrow ought to additionally consider his responsibility in formally making sense of what is means for an intention to be "sufficiently close." The closeness thesis is rather vague in nature and Morrow must formally justify why closeness includes SRM, but not climate change if he hopes to use it as a tool in highlighting a moral constraint.
[52] Morrow, 134.

Premise 2: The intentions of geoengineering are sufficiently close to the harms that might spring from the practice.[53]

Premise 3: The intentions of burning fossil fuels are quite distant from the harms of climate change; atmospheric pollution is not sufficiently close to the consequences of climate change.[54]

Conclusion: Geoengineering is morally worse than climate change. (This qualifies as a moral constraint under the Risk Profile* argument.)

In the remainder of this thesis, I attack this argument in two ways. First, I object to Premise 3, arguing that it only appears true because of a false assumption Morrow makes. Second, I object to Premise 2, claiming that geoegnineering's intentions are in fact *in conflict* with its risky consequences, while intentions regarding fossil fuel production *depend upon* climate consequences.

4D: Objection 1

My first objection, against Premise 3, is meant to discredit Morrow's claims by addressing his assumption that, when considering intentions of climate change, one should examine the intentions of individual emitters and polluters. Intuitively, it might seem reasonable to examine the intentions of all who contribute to greenhouse gas emissions in the literal sense—everyone who drives a car or uses power technically contributes to climate change on a larger scale. However, I claim that this assumption is not useful, equitable, or morally significant. Instead, one should consider the intentions of influential climate actors, like influential politicians, lobbyists, or oil industry giants. When one rightfully studies these intentions, climate change faces the same moral scrutiny as Morrow claims geoengineering does.

Climate change decisions should not be ethically explored on the level of individuals who contribute to carbon emissions. There are at least three reasons why this framework is not morally significant or satisfying. First, individual polluters have no power over the overall trend of the earth's increased emissions, in that even if one stops contribution, they have no capability to have a non-

[53] Morrow, 134.
[54] Morrow, 134.

negligible effect. Individual contributions to pollution do not equate to the moral gravity of climate change as a general trend. Of course, I do not argue that lack of wide influence releases one from a responsibility not to pollute. I merely argue that it is more useful, in exploring intentions behind vast phenomena like the use of fossil fuels—to explore intentions of those who hold wide influence in their continued usage.

Second, individuals cannot expect to lead any sort of normal life without using fossil fuels given lack of infrastructure or feasible alternatives. It seems difficult to discuss individuals as "climate change decision-makers" when they have little control over the choice to use a car (often necessary to get to work, obtain food, etc.). Without a vehicle to survive or thrive via a non-emissions lifestyle, it hardly seems that individuals should count as independent agents taking action to be evaluated as intentional or not, as they do not possess the self-determination necessary to pursue alternate means of livelihood. Analogously, someone forced to commit a crime (via coercion, threat, or forcing) certainly is not subject to the same moral scrutiny as someone acting freely.

Finally, it is likely most feasible to lead an entirely non-pollutant life in a case where someone is very wealthy—it seems unjust to ethically condemn a polluter as an actor just by living the only life available. An emissions-free lifestyle, or a lifestyle that depends largely upon clean energy, requires funding that many do not have access to. Proponents who claim that individuals are considered agents in making decisions that contribute to climate change automatically grant the wealthy the privilege of moral permissibility based upon their capacity to monetarily achieve it.

Given these objections, I will not assume responsibility or truly self-determined intentions of individuals in contributing to climate change. In other words, I will not subject individuals to the level of moral scrutiny I shall bestow upon powerful entities that possess notable power in contributing to climate change. The objections discussed above do not apply to powerful players that make significant impacts

in the climate change process. The table below illustrates that (for example) oil industry giants are highly-powerful, highly-funded, and highly-influential in dictating the earth's climate future.[55]

	Individuals with average income	**Oil industry giants**
Motivations in using or producing fossil fuels	Daily survival, a means to get to work, a means to warm one's house	Profit
Level of power in influencing the trajectory of climate change	Low	High
Alternatives to using or producing fossil fuels	Scarce—there is no genuinely robust energy replacement that does not require robust funding	Other business or industry opportunities are plentiful[56]

In comparison to relatively powerless individuals, such influential actors seem more genuinely responsible for climate change trends and greenhouse gas contributions to the earth's atmosphere. This is relevant to the objection because it indicates that their intentional contributions to climate change are noteworthy in comparison to that of comparably powerless individuals. Going forward, I discuss climate change and geoengineering's moral status based upon Double Effect with this assumption in mind.

Given my revised assumption, I shall readdress the question of climate change and Double Effect*. To do this, I answer the following question: are the effects of the oil industry's production and distribution of products that emit greenhouse gasses into the atmosphere "sufficiently close" to an actually intended effect that would bring about the same consequences?[57] In other words, although climate change is not intended, are the intentions of the oil industry close enough to such intentions such that these practices are still deemed problematic by Double Effect*?

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[55] For brevity and clarity's sake, I exclusively discuss the intentions and responsibilities of major oil industry players in the remainder of this thesis. However, a number of other powerful actors could also be discussed, such as politicians or lobbyists. These, too, would be preferably considered over "regular" individuals who contributing to pollution for reasons similar to those stated in the table.

[56] It could be argued that I am not being charitable enough to oil industry players. After all, expertise in the fossil fuel realm, costs of machinery, and connections in this field are all important things that cannot easily be abandon to pursue other business ventures. That being said, ease of such a transition is far greater than that of one who has *no other feasible option*. Often, regular individuals have literally no other means within their financial reach to live life any other way than through fossil fuel dependence.

[57] Morrow, 134.

I argue that oil industry intentions *are* sufficiently close to an intention to degrade the environment via climate change. In Foot's example, the reason that it is not permissible for the spelunkers to blow up a cave wall a foot away from their wedged comrade is because their intentions are not genuinely disparate from those that blow him up directly in order to escape. Recall Morrow and Foot's explanation: "the fat spelunker's death is too obvious and immediate a consequence of the latter plan [where the wall directly beside him is dynamited] for it to count as a foreseen but unintended side effect."[58] This same message surely applies to climate change, as well. Of course, no oil industry giant seeks specifically to summon environmental destruction for destruction's sake. But since their practices are the exclusive, primary and widely-recognized causes of climate change, these dire consequences seem similarly "too obvious and too immediate" to classify as merely unintentional. In other words, to only recognize the consequences of the oil industry's production and distribution of products to "unintentionally" cause climate change does not genuinely capture what is at work. This is especially true because the production of fossil fuels (at current scale) *necessarily* erodes the environment in order to garner profits and benefits—production could not commence in any other way. The harms imparted on the world occur *in order to* garner a profit, not coincidentally and unintentionally.

4E: Objection 2

In objection to Premise 2, I argue that the oil industry's intentions are *much* closer aligned to environmental degradation via climate change than intentions of those who implement SRM. As previously discussed, climate change is literally a stepping-stone and necessary condition to achieve the intentions of oil industry players. The intentions of oil giants and actual outcomes are closely intertwined, and the consequence of environmental damage might even be described as a pillar of their production process. Conversely, if we assume SSI's intentions are to improve dire climate consequences, their motives are squarely opposite of unintentional risks it might pose via other environmental harms it

[58] Morrow, 134.

threatens to impart in specific areas of the world. Given the intimate ties between fossil fuel production and climate change, it seems strange to highlight moral worries surrounding SRM via Double Effect*.[59] Geoengineering's intentions to salvage the environment seem quite distant from its risks, while climate change's intentions are very near the intentions of oil industry players.

4F: Reply

In reply, one might attack my argument against Morrow's Premise 3. My argument hinges upon the assumption that the intentions of individual polluters should not be considered in a discussion about Double Effect* because they do not possess an adequate level of self-determination to have the power to act differently. A replier might claim that similar limits additionally apply to oil industry giants. Although renewable energies are more robust than ever, and gaining some speed, they are certainly not adequate to meet the entire world's energy needs. It could be argued that oil industry giants are not merely motivated by profitable outcomes, but also serve as necessary institutions for powering the world—without their "services," countries would be ill-equipped in terms of power. Perhaps oil industry players are powerless in a different way: they must perform energy-providing roles in order to maintain the type of life humans currently enjoy (e.g. ability to freely travel, warm one's house, etc.). A world with energy shortages on a large scale would be chaotic, panicked, inefficient, and would promise other serious harmful consequences. Given this important role, perhaps the intentions of oil industry giants similarly lack freedom and agency, in that they must provide an essential service.

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[59] On page 134, Morrow explains that "intuitively, the risks created by SRM are much closer to the intended effects of SRM than the risks created by fossil fuel use are to its intended effects. In each case, the risks come from climatic changes, which climate engineers intend but polluters do not." Morrow uses this puzzling statement to justify that geoengineering should be wary of Double Effect* if it hopes to maintain permissibility. The intention of geoengineering is to negate climate destruction onset by fossil fuel emissions. *The intention is far from and actually the opposite of potential risks it carries* (i.e. unfortunate climate effects). It is confusing that Morrow attempts to claim that geoengineering's intentions are closely aligned with its risks when they are literal opposites. Because Morrow's justification for claiming that geoengineering is impermissible via Double Effect* is simply untrue, his claims should be considered with scrutiny. This is emphasized when considering the intentions of oil industry players, which *do* genuinely align with the unfortunate consequence of climate destruction.

In evaluating the reply, I argue that despite this tricky position, oil industry players are still wildly powerful and free to act as they please—their intentions can still be considered unencumbered and adequately uninfluenced by power constraints. The reply does not alleviate the decision-making responsibilities and intentions behind them for large fossil fuel producers. Such industries have robust funding, excellent legal support, institutional power, and political sway that is no where near comparable to that of an individual polluter. Such power allows them to act in ways that promote renewable energies or emissions-limiting mitigation policies while still producing fossil fuels for the world to use. However, this power is seldom wielded in the favor of environmental protection in a genuine way: it would be baffling to observe a fossil fuel lobbyist arguing for stricter emissions regulations or promoting other forms of energy. For these reasons, the reply falls flat.

Conclusion

In writing this thesis, I posit that Morrow's objections to the pro-SRM Risk Profile* argument do not adequately it. First, because SRM decision-making is not analogous to Doing and Allowing situations he hopes to liken it to, he cannot claim that SRM is relevantly similar to classic "doing" acts. I hold that acknowledgement of mitigation strategy considerations are necessary for a truly complete discussion of SRM moral constraints to take place, because the Doctrine of Doing and Allowing is only coherent when action options are binary.

Morrow makes a similar misstep when considering the Doctrine of Double Effect—if he considered intentions and motivations of genuinely powerful actors—e.g. influential oil industry powers—he might be forced to conclude that *climate change* is ethically impermissible instead of SRM. In other words, both of Morrow's arguments alone do not to throw light upon the ethical standing of geoengineering, and he must tackle a large burden of truth to posit his original worries about moral constraints. His approaches are useful, however—SRM is a risky strategy

to cope with climate change consequences, and requires adequate ethical consideration before both research and implementation.

Once again, my philosophical conclusions should not be conflated with a comment about the permissibility of geoengineering overall. Before the moral status of SRM is genuinely concluded, there are a vast number of justice and ethical issues that still must be addressed. My conclusions in this thesis are somewhat narrow, and merely purport that a specific treatment of specific principles fails to manifest ethical issues with the practice. Instead of making a grand comment on the state of this technology, I make a comment about the philosophical work still needed to be done and this discussion's rightful place in policy decisions.

I additionally hope to impart the notion that a philosophical analysis of this rigor ought to be pursued by any policy or decision maker confronted with tasks related to climate mitigation techniques that pose large risks. Although it might be tempting to use lay-knowledge to inform these decisions, I hope for this analysis to illustrate why mere intuitions are not robust enough to consider potentially grave harms. Philosophical principles can be used to describe ethical values that policy-makers strive to achieve. Presently, policy-makers do not include this sort of analysis during the policy-making process. Bluntly navigating moral constraints with mere intuitions threatens to exclude the needs of vulnerable stakeholders, to mis-weigh harms and risks, and to vilify potentially helpful mitigation techniques. A philosophical analysis ought to serve as a stepping-stone to responsible policy-making, informing it much like economic, ecologic, and anthropologic disciplines.

Finally, it should be noted that this sort of analysis would be useful for a wide range of conflicts and harms inherent in the broad field of marine and environmental affairs. Policy

decisions almost always invoke some sort of trade off between benefits and harms, and although this can be explored through other disciplines, philosophy is uniquely adept to discuss them.

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