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Geo-engineering: a curse or a blessing?

Marcel Wissenburg¹

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SUMMARY

In recent years, geo-engineering has been suggested as a viable strategy in dealing with climate change, the main indicator of what has become known as ‘the Anthropocene’. In this paper, I investigate the effects of geo-engineering in terms of freedom – not the only but perhaps the most important measure of moral and political desirability. Is geo-engineering a curse or a blessing, a poison or a medicine? I argue that four interpretations of the concept of freedom are relevant to this case: effective freedom (understood as ‘actions one can undertake’), opportunity freedom (a misnomer since it stands for *the value of* freedom), and liberal versus republican freedom. While the freedom effects of geo-engineering may well be (positive but) negligible for individuals, they will be considerably larger for states and societies, and moreover negative in terms of independence. Paradoxically, both individuals and society that value a private sphere (respectively sovereignty) will need to embrace a degree of republican freedom to protect that liberal freedom.

KEYWORDS: Anthropocene, Geo-engineering, liberal democracy, liberalism, ecologism

A Word of Warning

Actually, two words of warning. One is the usual mantra: please do not quote without the author’s permission because this (really, really) is still a draft et cetera et cetera. You know the drill. The other is that I consider (footnotes in) conference papers a rare and irresistible opportunity to have a bit of fun – Nietzsche’s gay science and all that. Most of these footnotes will probably have to be deleted from future versions because referees have no sense of humor. Unfortunately.

1 INTRODUCTION

One does not need to be a Marxist to realize that new technologies, from fire to the atom bomb, can change the rules of the game. In response to climate change, scientists and engineers are developing an ever expanding set of technological schemes to be played out on a very large to literally astronomical scale: geo-engineering. To apply them and as a consequence of their application, political structures and institutions from the global to the regional would need to adapt. That makes geo-engineering a problem for political theory: is this the future we want for our societies?

¹ Department of Public Administration and Political Science, IMR, Radboud University, Nijmegen, the Netherlands, m.wissenburg@fm.ru.nl and www.wissenburg.nl. I am grateful to the students of KSV Franciscus at Wageningen University, on whom I had a first chance to experiment with these ideas in March 2016. No students were harmed in the composition of this text.

The idea of geo-engineering raises worries, initially of an intuitive nature. Let us get the most popular one out of the way immediately: the intuitive fear of divine punishment reflected in classics like Prometheus, Faust and Frankenstein – should Man play God? I consider this type of distrust of technological change a fallback on primitive faith in the supernatural and leave that to the realm of fantasy, fiction and theology.

This paper addresses another intuitive reservation, a cousin to Rousseau's paradoxical notion of democracy. It is a special case of the benefits and burdens calculus, which, in the vocabulary of theology and fantasy, asks whether geo-engineering is a curse or a blessing, or in more modern terms (Derrida 1981): is it a poison or a medicine? Geo-engineering promises us (whomever that may be) on the one hand an unparalleled kind of control over our world, another great step forwards for humanity liberating itself from slavery to nature, but, on the other hand, this immediately implies that we control life ourselves more than before, and since *l'enfer, c'est sont les autres*, we become (even more) each other's slaves. Does geo-engineering liberate or enslave us?

The choice of freedom as a measure for the desirability of geo-engineering is not an accidental one, and will be explained below. Let me however stress the obvious: freedom is certainly not the only measure worth applying – there is also equality to consider, justice, democracy, happiness, tranquility, modesty, the integrity and possibly independent value of nature and the wild. Nor are moral and ethical categories the only concepts suitable for a confrontation with geo-engineering – more acutely than any technological change so far, geo-engineering raises (for example) the ontological question whether a social construct like nature (vs culture; cf. Descola 2013) is still an appropriate term to use for the object of our regulatory affection.

My argument is structured more or less as a pragmatic thought process, an attempt to move from (un)considered judgments to a reflective equilibrium (cf. Rawls 1999a): I try to get a better appreciation of geo-engineering by refining conceptions of freedom, and refine those by trying to better understand the freedom effects of geo-engineering. The tale proceeds as follows. In Section 2, I introduce the objects of my research: the Anthropocene, from which discursive context arises Earth Science, which in turn creates room for geo-engineering, the Third Way in climate policy. Next, in Section 3, I categorize and describe the different types of effects geo-engineering could have on our lives. Even though I include some examples, the typology will remain fairly abstract and feel intuitive – intentionally, so as to stress the different, incompatible and contradictory, directions in which our everyday judgments send us. Then we move on to the analytical part of the paper.

In Section 4, I discuss the importance of freedom as a standard by which to measure the (non)desirability of geo-engineering, and I investigate a number of ways to measure freedom. The nature of those measures obviously depends on one's conception of freedom – which is why I briefly discuss the wide variety of conceptions of freedom, and select four that, or so I intend to show, quite adequately explain the confusion we feel when merely intuitively assessing geo-engineering. Those four are effective freedom, opportunity freedom, liberal and republican freedom.

I apply these conceptions in Section 5 to the types of effects geo-engineering would have on humans and their lives as described in Section 3. Not to give away too much too soon, I shall argue that, in terms of effective freedom, geo-engineering is collectively liberating, in that it increasing the options for (some, particular) collectives to shape their lives in accordance with their wishes, while at the individual level, geo-engineering's freedom effects are morally neutral (though theoretically posing a threat). Geo-engineering introduces more *artificial* limits to the individual's choice set (limits that were once natural), but if freedom is measured in absolute terms rather than percentages, then it does not necessarily decrease our freedom – it all depends. On the whole, anyone who values freedom intrinsically (deontologists, i.e., not necessarily liberals only), should give geo-engineering a guarded welcome. In terms of opportunity freedom, the freedom to make choices between *valuable* alternatives – well, apart from the fact that this is technically not a type of freedom but a judgment on the quality (value) of freedom, whether or not geo-engineering increases one's opportunity freedom simply depends on one's personal ethical and political inclinations.

In terms of liberal freedom, the freedom of a private sphere not interfered with by the public sphere, it would appear that geo-engineering is a direct threat (thus, politics should obstruct and prevent geo-engineering), while from the perspective of republican freedom, freedom as collective self-governance, geo-engineering is enabling and therefore beneficial (thus: should be promoted). Yet I will argue that this is too simplistic a picture: given the overall neutrality of the effects of geo-engineering on the individuals' freedom of choice, there are neither incentives nor disincentives to participate in collective climate management, but the potential side-effects of geo-engineering (measured in terms of opportunity freedom) make it prudent or even a positive duty to positively appreciate the increase in republican freedom that geo-engineering allows. The same applies to states and societies: the only way to protect the equivalent of liberal freedom for states, embracing the equivalent of republican cooperation is the only option. To put it a bit bluntly: liberals who reject geo-engineering as an intrusion on their sovereign private sphere, live in denial and exhibit classic signs of fear of flying.

In the concluding Section 6, I investigate two further questions: does my argument apply to climate technologies ('ecofixes') that are less invasive, less global than geo-engineering; and does it apply to the only absolute alternative to geo-engineering, abstention or as some proponents of geo-engineering have labeled it (Dalby 2007), eco-quietism.

2 HAND IN GLOVE: GEO-ENGINEERING AND THE ANTHROPOCENE

While it took some time to take root, the term 'Anthropocene' has now become one of the most popular buzzwords in virtually all academic and political discourses addressing climate, environment or ecology. It therefore needs only a brief introduction: the term denotes 'the Age of Man',² the period of roughly the last two centuries during which human activities would have had an impact on the global and global ecology (or as the advocates of the term say, 'Earth System') equal to anything that defines, in geology, biology and climate science, an era (like the Pleistocene, Holocene etc.).

It is worth noting in more detail, though, that 'Anthropocene' is a social construct and most definitely not a politically neutral concept, not a 'purely objective, scientific term' – if such a thing can exist at all (cf. Baskin 2015, Lepori 2015, Luke 2015a, 2015b, Schlosberg 2016, Di Chiro 2016). It was introduced by the same people who brought you 'global warming' and 'climate change', a group of mostly climatologists and natural scientists centered around Nobel Prize winner Paul Crutzen, to whom I will refer as 'the advocates of the Anthropocene' (Wissenburg 2016) or simply as 'the advocates'.³ The idea of an Anthropocene does not just presume that humans can be seen as the independent variable in the causal chain explaining climate change (in itself at least philosophically a questionable hypothesis) but also implies that 'we humanity' (an oversimplification typical of the naïveté with which the advocates approach politics) are morally responsible, if not for the mess then at least for cleaning it up. (Not to mention other grounds for hesitation; cf. e.g. Cox 2015, Trachtenberg 2015).

The advocates, in other words, have a political agenda which they vigorously pursue: they actively promote global climate policy aimed at halting climate change before it reaches a 'tipping point' (another of the advocates' favorite discursive weapons). This global climate policy is to be based on and guided by Earth Science (cf. Lenton 2016), a comprehensive (the advocates usually avoid the hippy-term 'holistic') body of knowledge created by ever closer cooperation between the various natural and life sciences studying Earth System.

² That's 'the Age of Humankind', of course, but PC language has not yet made a deep impact on the natural sciences community.

³ Cf. also Dryzek, Norgaard and Schlosberg (2013: 111ff.). Any similarity with Terry Pratchett's Auditors is purely coincidental.

The advocates' political naïveté shows itself in the simplistic understanding of the role of (Earth) science in environmental policy (Wissenburg 2016, cf. also Dryzek, Norgaard and Schlosberg 2013). Its goals are apparently objectively given (the continued existence of humanity at the same or higher level of material welfare with the same materialist preferences), hence there is no need for climate politics, let alone for 'the political', only for climate policy – it's all merely a matter of effective, efficient implementation. Viable alternatives do not exist, say Earth Science proponents: the back-to-nature quietism of radical ecologists like Robyn Eckersley or Andrew Light (*biens étonnées de se trouver ensemble*) is 'impossible', eco-quietists live 'in denial' (Dalby 2007). The advocates' faith in expert rule and their lack of interest in liberal values like freedom, democracy and justice remind one of the 1930s proponents of technocracy and are, frankly, disturbing.⁴ Even in more recent reflections on the future Earth Science (Oldfield et al. 2014), where it is to include some of the social sciences to help smooth the political path for global cooperation, there is no talk of an open society.

It seems wise then to use the term Anthropocene with care and hesitation (cf. Lepori 2015, Luke 2015b). Its use certainly implies that one buys into the idea of collective moral responsibility for climate change and climate policy, and of a collective ability to steer the global climate. No role for structural factors there. It thereby also implies duties of cooperation that may overrule as less urgent liberal hesitations and reservations (e.g. on the human rights policies of some major 'partners' in climate policy). One may adopt even more unwholesome ideas by taking over the rest of the advocates' technocratic vocabulary, 'Earth Science' and 'Earth System' for starters. Whether it is epistemologically possible to 'think' or 'de- and reconstruct' the Anthropocene without the illiberal content deserves more attention than it now gets from over-enthusiastic 'early adopters' (e.g. Williston 2015; cf. Schlosberg 2016).

Back to the main story line. While geo-engineering is not originally part of the advocates' Anthropocene discourse (its roots probably lie in the notion of terra-forming as developed in pre-WWII science fiction and early space exploration), it fits hands in glove with the idea of Earth Science guiding climate policy. Two basic answers to the challenges of the Anthropocene exist: adaptation (to the inevitable) and mitigation (of the inevitable). Geo-engineering offers a third strategy – hence, one might say, a Third Way in climate policy: making the inevitable evitable by changing the climate itself (cf. Lenton 2016). Strictly speaking, there is only a difference in degree between mitigation and geo-engineering, but that degree is anything but minute: a carbon filter in your car exhaust and deflecting the planet's sunlight in outer space are in different categories altogether. Geo-engineering is far more ambitious - Dryzek, Norgaard and Schlosberg (2013: 120) aptly call it 'The Anthropocene on steroids'. It exclusively uses physical technologies, not policies or other forms of regulation of human behavior; and it does so with the explicit purpose of controlling Earth's climate, i.e., the entire planet's system of ecosystems, rather than affecting climate conditions for any particular region only.

Where exactly geo-engineering ends and 'something else' (e.g. terra-forming or mitigation) begins is of course a matter of convention. In some contexts, geo-engineering is limited to (by definition global) climate control through CO₂ removal (say: the *reagens* of the climate system) and decreasing the planet's absorption of solar radiation (the *agens*). But broader definitions also exist – e.g. ones including other greenhouse gasses and other processes affecting the climate. What these techniques always share, though, is the use of large-scale high-tech solutions: planting trees may *technically* affect the climate but would be understood as geo-engineering only when applied on a global scale with measurable global effects; iron fertilization of the oceans is the real thing.

Two things geo-engineering is (again, by convention) definitely *not*: directed at input or output, and unintentional. First, it (apparently) takes human life as it is. Geo-engineering aims to affect the climate

⁴ Even more disturbing is the influence the advocates are gaining in politics. I was recently asked to comment on a Dutch government think tank's draft report on future climate policy, which would be (roughly) to let the main goals of climate policy be set by experts (read: natural scientists) exclusively, leaving only details open for democratic deliberation. The draft report also referred to working documents from think tanks in the UK and elsewhere proposing similar strategies.

system, not (cf. Dobson 2016) material consumption, production or population size, nor human physiology (e.g. ‘engineering’ higher tolerance for heat and humidity). Both the existing consumption patterns and production system are taken for granted, and human engineering is simply not in the picture. Second, it excludes (policies and) technologies with global climate *side* effects and technologies with regional effects. An example of the first would be the use of renewable energy sources (their primary aim being to replace depleting resources, not to affect the climate). Examples of the second abound. One set of examples would be the border-crossing effects of national water management policies in the Middle East, the south of Russia or California have border-crossing political repercussions as well - for Israel and its neighbors, the relation between Russia and its southern satellites, for the relations between California and e.g. Nevada. Another example: Indonesian and Brazilian rain forest management (admittedly more a political than technological problem) has traditionally been blamed for an important part of climate change. Yet while there is no politically significant difference between a country being confronted with the side-effects of another’s environmental policy, and its being affected by a geo-engineering project in which it did not participate – it does make a difference for the definition of geo-engineering.

Even if only for the sake of argument, but also to avoid slippery slopes, I will stick from here on to a fairly strict understanding of geo-engineering as the use of purely physical technologies with the explicit purpose of controlling all the planet’s climate. In the conclusion, I will nonetheless briefly venture on the slippery slope to ask if less ‘total’ technologies have different freedom effects than geo-engineering – and I will ask the same question regarding eco-quietism.

Geo-engineering does not promise exact control over your neighborhood’s temperature, humidity and wind tomorrow – it may not even be physically possible, ever, to micromanage the weather. But with Earth Science it does promise more control over where ecosystems change and how they develop, than merely in terms of temperature. It promises a fairly detailed degree of global and regional climate engineering, with effects on seasons and thereby (by definition) on a region’s *average* weather conditions. It also sets limits to the possible composition of regional ecosystems (our limits, designed and defined by societies) – thus promising us the freedom to design our *bodies ecologic*: the ensemble of our bodies politic and the natural environment in which they might flourish, in turn side constraints for agriculture, architecture, culture etc. (cf. Wissenburg 2016).

However defined, geo-engineering is mostly science fiction so far, not due to any technical or physical causes since no lack of adequate data has ever before stopped scientists and engineers, but for lack of political support: geo-engineering is, rhetorically and perhaps ideologically, several bridges too far for existing liberal-democratic nation-states. Given the choices, the freedoms it promises, it is inevitable (in fact, I would argue, a moral duty) that we ask ourselves if we should embrace the idea, stimulate the development, and prioritize the exploitation, of geo-engineering technologies.

3 WHAT HAS GEO-ENGINEERING EVER DONE FOR US?

The Anthropocene (and with it geo-engineering) is both nightmare and utopian dream. It is a utopian dream in that, although it does not annul the laws of physics and human nature, it does take away one of the most important impediments to human control over the conditions of our lives: the global natural environment can now be shaped rather than shape us. Actually, as the advocates correctly observe, the option of letting nature shape us no longer exists: since nature is under control, ‘letting nature run its way’ is now the choice for one nature management technique over another.⁵ Pandora’s box has been opened,⁶ there’s no going back. Like nuclear technology, it can be used or not but it cannot be unlearned. Yet at the same time it is a nightmare. We now carry Atlas’s burden and more: we are apparently bound to band together, cooperate, adapt individual dreams and hopes to those of

⁵ Even if geo-engineering is still science fiction, ‘letting nature run its way’ as a nature management/design technique has already been adopted on a wide scale under the name ‘rewilding’ – cf. Tanasescu (2015).

⁶ For the educationally challenged: ‘the cat is out of the box’.

others, or (if one opts out) see our living conditions determined by fickle humans rather than predictable nature. Again, to use the advocates' vocabulary, there is no 'rational alternative'. And so, it seems, individual freedom and dreams are further *limited* than before.

To make sense of the confusing range of effects geo-engineering could have, the simplest approach would be to treat it like any other new technology and investigate its reception in the form of a Technology Assessment (TA), measuring and weighing the costs and benefits for the various stakeholders (producers, consumers, and anyone affected by either). The format of a TA is not inappropriate here, and may be helpful as long as we keep an open mind to its shortcomings (cf. Barbour 1980).

A first set of shortcomings of TA has to do with the fact that it is basically a simple cost-benefit analysis (adding 'opportunities and threats', i.e. turning it into a SWOT analysis, changes little: both bring, and therefore can be reduced to, costs and benefits.) To measure costs and benefits, one needs to know whose costs and benefits, i.e., one needs to identify the stakeholders; one needs to identify (more precisely, predict) the different dimensions or aspects where costs and benefits might arise, and one has to take into consideration that a different demarcation and choice of stakeholders affects the identification of potential effects. Humans aren't very good at predicting the future using crystal bowls. The best alternative we probably have is to compare a new technology to a similar one introduced not too long ago, realizing all the time that similar is not the same – thus, geo-engineering may still turn out to be received differently. In our case, we are looking for a technology with global impact (for which the A-bomb and the microchip might qualify) that requires at least multinational and preferably global cooperation to use (for which neither qualifies). I would suggest that the closest we can come to a technology similar to geo-engineering, but one that is unfortunately still predicated on the existence of a human rather than natural enemy, is Ronald Reagan's 'Star Wars' rocket shield.⁷ As for the choice of stakeholders – I'll address that below.

Another cluster of shortcomings has to do with the measurement of predicted costs and benefits. Wherever this is not a straightforward matter of money (and in fact even then), cost-benefit assessment involves value judgments – for example, in the context of dictatorship or simpler smart phones, is 'less time needed for decisions' good or bad, and how good or bad? A related classic TA problem is that one's research design may seduce one into measuring the researchers' rather than the stakeholder's preferences. And finally, TA tends to try to use one measure for all costs and benefits – usually money. Since I've already made this an investigation into the freedom effects of geo-engineering, we can circumvent part of this problem by adopting freedom lost and gained as a measure, freedom being provisionally defined as 'actions one can undertake' (for a defense see Section 4), but as we shall see in Section 4, there are more valid and reasonable conceptions of freedom – hence our TA will remain incomplete and biased. (Still, it will be good enough to inspire a research agenda.)

One further set of problems is easily avoided. TA tends to be used to assess the economic viability of a technology, hence it often aggregates results for all stakeholders, ending with one simple 'on balance' figure. We do not need to do that here; in fact, we are not interested in the overall effect of geo-engineering but in determining more precisely the different effects of geo-engineering on different parties. That way, we can avoid the classic utilitarian's problem associated with one measure for all things: making it look like one would sell one's grandmother if the price were right. Not all freedoms are interchangeable.

Finally, a TA meets one problem any alternative would meet as well: uncertainty about the way the new technology actually works (and if multiple uses are discovered, how it will be used). All we can do, for the sake of simplicity and for the sake of argument, is assume that (any form of) geo-

⁷ It has been suggested, not only by Hollywood movie writers, that Star Wars be used against incoming meteors and comets. Turning the shield against a natural enemy might make the comparison stronger, especially if we apply the same standard to TA as we do to pick good science fiction: let's not make more than one improbable assumption. Which makes Star Trek better than Star Wars, by the way.

engineering, once applied, will work and will work precisely as predicted; there is no uncertainty and risk to take into account, no fear, no (false) hope and disappointment (with all its ripple effects on choices and behavior). But we will return to this unlikely assumption⁸ in the conclusion.

So who then are the stakeholders affected by geo-engineering, and how will it affect their freedom (the set of actions they can undertake)? Again, for the sake of argument, I have to oversimplify and exclude all sorts of in themselves quite interesting and relevant stakeholders at the meso-level: the various genders, religions, clans and families, communities, lifestyle groups and so on.⁹ I will limit myself to three stakeholders: individuals (whom I will assume to be representatives of themselves not bloodlines, *pace* Rawls); societies, politically represented by states;¹⁰ and humanity as a whole – the advocates' primary object of concern.

How would geo-engineering affect these three in terms of 'actions they can undertake'? I have already hinted at a couple of implications for the individual. Except in a James Bond film, no individual is likely to ever be in a position where he or she can singlehandedly change the world's climate: in that sense, geo-engineering does not affect what an individual can or cannot do. The more one's life plans depend on the climate, though, the more geo-engineering affects those plans: a software engineer may be able to live the same life at any average temperature between 0 and 30°C, that is obviously less likely for a family farmer. Yet in terms of freedom, the effects of the introduction of geo-engineering seem to be immaterial: it changes the source and direction of the climate and of climate change, not its nature. The only sense in which geo-engineering apparently affects individual freedom is that it forces individuals (some more than others) to reassess their plans of life more often, since one now has to adapt not only to a known quantity, the relatively slow and predictable type of climate change before geo-engineering, but also to any potential change of course effected by geo-engineering. Geo-engineering thus seems to negatively affect the room one has to lead a life of tranquility. In addition, in any society where any kind of politics exists,¹¹ geo-engineering becomes part of the political agenda, and affecting the agenda on this new item is yet another choice offered to (or some would say, forced upon) the individual.

While it is not unimaginable that a state can 'go it alone', can unilaterally geo-engineer our climate¹² – it is never politically wise to do so. The realities of international relations therefore force nations to cooperate, if they want to employ geo-engineering technology, and that substantially affects their freedom. Cooperation on the scale required implies that the conditions for each society's survival and existence, for the shape of its body ecologic, thereby its economy, culture, population, socio-political system etc., are set not by that society itself but by a minimum winning coalition (or in the dreams of cosmopolitans and the advocates, 'the global community'). On the plus side,¹³ geo-engineering will allow states, within these internationally set boundaries, to guide their societies with far less pain and unrest to a far more prosperous future than the alternative offers.

Finally, humanity as a whole stands to gain from geo-engineering: it empowers. In addition to all the already existing options for our ecological future (from back-to-nature eco-quietism for a world population of less than a billion to twenty billions drowning in sweltering heat), it offers at least one more – or so the advocates would argue.

⁸ See the previous footnote.

⁹ Note that the option of geo-engineering can affect such groups deeply (cf. Dryzek, Norgaard and Schlosberg 2013). I expect the Church of the Flying Spaghetti Monster (which sees a causal link between the falling numbers of pirates and the rise in temperatures worldwide), for example, to split on welcoming progress (promoting law and order, making piracy superfluous) and rejecting it (for undermining redistributive justice and reducing lifestyle choices).

¹⁰ I am aware that states and societies do not necessarily coincide. For the sake of argument, etc.

¹¹ Deliberation and participation are not limited to western liberal democracies, but are a necessary part of any decent society (cf. Rawls 1999b, Crick 2000).

¹² One of the premises of the advocates of the Anthropocene is that they already do so indirectly, which would cause the problems that make geo-engineering necessary in the first place.

¹³ For the consequentialist, even slavery can have a plus side.

4 FREEDOM, WHY AND HOW

Why freedom¹⁴? Why not assess geo-engineering instead in terms of other possible criteria like equality, justice or democracy? To answer both in one breath: freedom is the foundational value not just in the (very, very) broadly liberal political discourse that dominates political thought in our era, but by definition in every normative political theory, since there is no sense in attributing blame or praise for (not) meeting any moral standard in the absence of choice, i.e., freedom. Freedom is a necessary condition for moral action. That said, not every political theory appreciates freedom *intrinsically*, i.e., regardless of context.

While I do not limit myself to *individual* freedom in this paper, I should add that there are nonetheless grounds to pay special attention to the effects of geo-engineering on individuals: only individuals bleed when you prick them. Geo-engineering has been absorbed into the vocabulary of the Anthropocene, which in turn is a discourse of sustainability. Sustainability (basically economy supersized: the virtue of frugality extended to include the management of natural resources) makes sense only either in the context of global environmental justice, where it is ultimately the distribution of environmental benefits and burdens over individuals that matters; or in the context of obligations to future generations, read future individuals, and/or the options presently existing individuals have for the creation of future individuals.

The TA in Section 3 was based in a fairly simple understanding¹⁵ of freedom as ‘actions one can undertake’. But that is an ambiguous concept, for example because it can mean ‘actions one is (legally, morally, etc.) permitted to undertake’ or ‘actions one is not inhibited from undertaking (by human, moral, legal etc. obstructions)’ – both alternatives representing sets of possible interpretations of Berlin’s negative freedom (Berlin 1969; cf. MacCallum 1967). ‘Actions one can undertake’ can also refer to the Berlin’s first interpretation of positive freedom as having (been given) the *means* to do something – and there is probably no need to remind the reader how confusing, even internally contradictory, the various interpretations of positive freedom turned out to be. Some of that confusion has to do with another concept with which freedom is often equated (or confused, depending on one’s vocabulary): autonomy, often defined as the individual’s internal (mental) capability to make (authentic) choices or design a plan of life, as distinct from freedom that would relate to the external conditions under which I must operate and execute my plan of life.

To end this confusion (that still persists in politics and side-tracks many a political debate), it has become customary to make a distinction between formal and effective freedom: formal freedom as the absence of human-made obstacles to do something, and effective freedom as (formal freedom plus) the presence of the physical means to do something (cf Swift 2013) – definitions which, by the way, make it essential to also strictly distinguish between freedom as an external and autonomy as an internal condition. An example: you are formally free to fly to the moon when no law forbids you to do so; you are effectively free to do so when you have the money, technology and a rocket; and you are autonomous when you can decide whether or not you would like to go to the moon. It is in this sense of effective freedom that I will use the expression ‘actions one can undertake’.

It seems obvious that formal freedom is not the category one would want to use to assess geo-engineering, but effective freedom may be (too) ambiguous as well. There is a long tradition interpreting (effective) freedom as *freedom of choice* – thus, the more choices you have, the more free you are (cf. Pattanaik and Xu 1990). Intuitively, however, enlarging your existing set of freedoms with

¹⁴ The obligatory caveat included in virtually every analysis of freedom must be added here as well: on the rare occasions where I may use the term liberty, I will do so as synonymous with freedom. As a non-native speaker who barely masters pidgin, I never understood the difference anyway.

¹⁵ ‘Definition’ would deny the active constitutive function and overstress the passive construction aspect of a concept like freedom.

(say) the freedom to be beheaded at dawn does not seem to a genuine addition to your freedom. According to Amartya Sen, ‘freedom gives us the opportunity to achieve our objectives – things that we have reason to value. (...) It relates to the real opportunities we have of distinguishing things that we can and do value’ (Sen 1993: 522). Sen, in other words, supported an interpretation of (effective) freedom as *opportunity freedom*, having valuable choices, rather than just any kind of choice.

As it turns out, though, opportunity freedom is a misnomer causing more confusion than it solves. What is a valuable choice may either be determined purely contextually (i.e., determined by an agent’s revealed or actual preferences) or by an independent standard for what ‘the reasonable person’ would deem valuable. The former makes freedom non-measurable and purely idiosyncratic; the latter simply means that a moral, ethical and political standard is called for – a theory of the good life, the good body politic and the good body ecologic. Bluntly put, the degree to which one has opportunity freedom will depend on the assessor’s party line. Opportunity freedom is not a measure of freedom, it is a measure of the quality or *value* of freedom (cf. Van Hees and Wissenburg 1999; Van Hees 2000).

Still, that opportunity freedom is a misnomer is no reason to discard the intuition that the value of effective freedom is important to us, just as effective freedom of choice itself is. There is a difference between choices that can have value and choices that cannot. One can value freedom intrinsically but it still needs to be the choice between one or more options, freedom being a state of affairs in which one ‘decides’: there has to be something to decide on, no matter how silly. Here Jonathan Swift’s Big and Little Endians come to mind: as long as the choice can mean anything to you, two alternatives are genuine alternatives and not identical.¹⁶

Freedom of choice and opportunity freedom (or effective freedom and the value of freedom) do not completely cover and explain all the guesstimates of the freedom effects of geo-engineering articulated in Section 3. There is one other pair of conceptions of freedom that is relevant here: liberal and republican freedom (cf. De Bruin 2009). Liberal freedom is what Benjamin Constant (1819/2010) called ‘the liberty of the Moderns’, the individual’s set of possible actions that remain exempt from government interference or control. Liberal freedom is larger the larger this private sphere is; the assumption being that all other imperatives that constrain one’s effective freedom in this sphere are the result of autonomous, authentic choice rather than alien intrusions. Republican freedom, Constant’s ‘liberty of the Ancients’, stands for living under laws that are the legitimate product of collective self-determination; republican freedom is larger the more ‘actions one can undertake’ are circumscribed by law (whether they are forbidden or prohibited is irrelevant).

5 ANALYSIS

We are now ready to revisit the ‘barely considered’ judgments listed in Section 3, and assess how well individuals, states or societies, and humanity as a whole fare in terms of effective, opportunity, liberal and republican freedom.

Let me start with the greatest disappointment: humanity. The idea that geo-engineering might ‘liberate’ humanity from the bonds of nature in terms of effective freedom (or indeed any other kind) is based on at worst over-abstraction, reification, at worst a romantic notion of a deep unity binding the species. To ascribe to that entity any kind of freedom, it has to be a self-conscious agent. To put it bluntly, I’ll see your Maggie Thatcher and raise you one: there is no such thing as humanity. There are only individuals eking out a living either on their own or in organized groups. In Giovanna di Chiro’s words: ‘The generality of these diverse political assemblages cannot be captured in the universal “we” of the Anthropocene story. It matters which stories, knowledges, and words/worlds make our environmental politics’ (Di Chiro 2016: 275). The closest we can come to identifying an entity uniting humans, thinking as one, acting as one and experiencing as one, is the United Nations. Perhaps there

¹⁶ I see ‘identical alternatives’ as an oxymoron. Confronted with those, you are free not when forced to choose between identical options but iff you can choose between choosing either one or none.

are contexts in which it makes sense to say that the UN ‘represents’ humanity (as an amalgam) – but to say that it *is* humanity is absurd.

The idea that ‘humanity’ is the beneficiary of geo-engineering is of course a direct implication of an idea shared by both the advocates and many others: that there is a global environmental crisis affecting all humans and threatening perhaps the biological survival of the species, certainly the cultural life of civilizations (Einstein’s remarks on the weapons with which WW IV would be fought come to mind here). This may not be the place to ask what makes the human species worth saving (or whether its disappearance would be an intrinsically bad thing), other than so that its existing members can lead a good life, and provided further procreation does no harm. But it is the place to point out the rhetoric involved in claims made on behalf of ‘humanity’.

Even at the constant risk of reification, it makes a bit more sense to ascribe agency (and thereby freedom) to civilizations, societies and their political incarnations, states: they do often act, more or less, as one, and in international relations understand each other as agents (though often complex agents made up of other agents). Now more Earth Science probably means more geo-engineering technologies, thereby more ‘actions one can undertake’, but things are a bit more complicated than that: the ‘one’ who can undertake action is not necessarily the state. Both for technological and political reasons, geo-engineering as such cannot be used by one state alone. Some geo-engineering *technologies* might be used as weapons (or threats) by rogue states, but geo-engineering itself is a long-term strategy that can easily be sabotaged by other nations.

In other words: geo-engineering does not increase but actually reduces individual states’ effective freedom; it can only increase the effective freedom of *coalitions* large enough to not be effectively obstructed by others – what one might call winning coalitions in a climate war. Even then, other conditions will have to be met: even a minimum climate-effective coalition ‘going it alone’ against the rest of the world may in the long term affect the climate to its advantage but threaten its global power, even survival, in the short run, i.e., it may on the whole see significant losses in terms of effective freedom. Either way, geo-engineering by definition implies a reduction of nations’ room to maneuver individually, i.e., their effective freedom is reduced.

In this context, it is theoretically possible that a coalition is formed uniting all states (the UN as a composite actor, not as the representative of humanity) – but that does require the global coincidence of both long and long term national self-interests, enlightened as much as primitive. It is more realistic to assume that, for now, not every state’s interest is necessarily served by geo-engineering, nor necessarily served by the (re)creation of any specific climate. Some states and societies stand to gain, not just lose, from global climate change, and may on the whole gain more than they lose – think of the resources that are ever more accessible in the polar regions.

If, and in so far as, it makes sense to talk about the effective freedom of states – then it might also make sense to talk about their opportunity, liberal and republican freedom. As far as opportunity freedom goes, we immediately run into the problem already discussed in Section 4: opportunity freedom isn’t really freedom – it is a judgment on the quality, the value, of specific freedoms, and that judgment depends on the agent’s theory of the good, plan of life, and so on. Applying those terms to societies might theoretically be sensible if one is a classic, orthodox communitarian but few others will agree. Applying them to states (or coalitions of states) reveals an interesting illustration of the variety of possible values of freedom. If one is an International Relations (IR) realist or neo-realist, the survival of the state is its ultimate goal: geo-engineering technologies in one’s own hand support that goal, and form a threat in the hands of others, while geo-engineering itself is nothing but a vital threat. If one adheres to a modern liberal view on IR, sovereignty is first of all a duty to serve the people, not merely a right to rule them – should a state fail to do its duty, it loses its right to sovereign rule. On that perspective, the necessity of coalition formation for geo-engineering to succeed, and the loss of effective freedom implied for states, suggests that a political constellation other than the state should take its place. The modern liberal view, in other words, has little room for the value of freedom for states – what matters is the freedom of individual human beings and their societies.

To talk of the liberal and republican freedom of states is not as odd as it may seem: there is no polity in IR constituting a public and protecting a private sphere for states – but there is a growing body of international law, of substantive international treaties and treaty organizations (cf. Wissenburg 2009), all of which bind states. Geo-engineering itself does not increase the effective freedom of states, hence neither (even the potential) size of their liberal, intrusion-free, zone of self-determination – but it does increase the effective freedom of coalitions, enabling outsiders to set (further) limits to that same zone. Of course, every state can hope that no others will want to use geo-engineering technology (for whatever purpose) but in this instance, geo-engineering is much more like nuclear technology than like Star Wars: it is unrealistic and irrational not to prepare for any eventuality. Paradoxically then, if a state wants to maximally protect its *pre-existing* liberal zone of non-interference, its control over its body ecologic, then it will have to embrace the global equivalent of republican freedom – it will have to actively engage in international cooperation and regulation of geo-engineering.

Finally – what are the freedom effects of geo-engineering for the individual? On the whole, they are not too different from, but more disheartening than, our observations for states. In principle, geo-engineering does not affect the individual's effective freedom: it is not 'an action one can undertake', not as an individual – which is why the concept of opportunity freedom is irrelevant here, too. For the individual, there is no difference between random climate and climate designed by committee. The one may be natural, the other artificial – from the point of view of the affected individuals they create and reduce just as much of their effective freedoms. In principle. There is, after all, a side effect to geo-engineering: if successful, and momentarily disregarding population effects and the non-identity problem, geo-engineering is supposed to create living conditions (and thereby opportunities, 'actions one can undertake') that are at least as good (respectively numerous) as when nothing had been done. For a consequentialist, this potential increase in opportunity freedom may or may not be fortuitous in terms of opportunity freedom. That verdict will depend on how much one values self-governance, tranquility, submission etc., and how much one disvalues human *hubris*, critical reflection and so on. If one values freedom intrinsically (as not just many liberals but all deontologists probably do), then one should give geo-engineering a guarded welcome. Guarded, because every silver lining of course comes with a cloud.

The cloud, the dimmer side of geo-engineering, has to do with liberal and republican freedom. Obviously (just as in the case of states) geo-engineering threatens to encroach on the individual's intrusion-free zone: 'the' polity, or at least a collective, determines how geo-engineering will be used, thereby determines its side-effects, and thus dictates which new actions you can and cannot undertake. And just as in the case of states, the protection of liberal freedom here suggests or even necessitates that one embraces republican freedom: to maximally protect the former, one's control over one's plan of life, demands increased political participation. What makes this a disheartening conclusion is that most individuals' impact on any global political problem is utterly negligible.

6 TIMEO DANAOS ET DONA FERENTES

To conclude: geo-engineering is certainly no straightforward blessing but it has potential. Assuming geo-engineering can work flawlessly, it will in one respect reduce the effective freedom of both states and individuals, since large-scale cooperation is required, in other words: self-binding. But it has a liberating potential in another respect: if it achieves not merely in climate but also in socio-economic terms what it is supposed to do: protect and improve living conditions, a.k.a. creating more 'actions you can undertake'. Whether that freedom is *valuable* is open to debate: the deontologist values freedom intrinsically, for the consequentialist it depends on whether or not geo-engineering supports 'the right' kind of society and the good life. In addition, geo-engineering will not necessary benefit everyone or every state – some benefit from climate change, some do not. Overall, however, it is irrational not to participate in the development and management of geo-engineering strategies. Like the Star Wars shield, geo-engineering as a whole and every distinct technique and technology can be

used as a weapon and will affect the effective freedom of each and every individual: retreating to some kind of private sphere (or ‘splendid isolation’ in IR) is not an option.

Distinguishing four types of freedom and a plurality of stakeholders helped us understand how utterly and perhaps hopelessly complex a sensible answer to the question ‘blessing or curse’ will be. After all, freedom is only one of many ethical concepts with which geo-engineering should be confronted. A paper, article, chapter alone is insufficient to accommodate a subtle analysis; hence I had to ban those other values to the realm of *ceteris paribus*.

I promised to return in this concluding section to three other loose ends: the assumption that geo-engineering works flawlessly, the question whether technologies less invasive than geo-engineering will have different freedom effects, and the question whether eco-quietism has different freedom effects. In all three cases, I will once more assume that some other things are equal: that population size and non-identity problems can be ignored.

(1) The precautionary principle and the whole idea of potentially disastrous failure are virtually absent in geo-engineering advocates’ publications.¹⁷ Of course, what counts as a technical failure or an unexpected side-effect does not *need* to be a disaster for humans – in terms of effective freedom, the impact on stakeholders’ freedom is simply unpredictable. It is obvious, though, that risk and fear will affect the opportunity freedom of many, and thereby their appreciation of geo-engineering – which is a roundabout way of saying that emotions and rational risk assessment may collide.

(2) Geo-engineering *aims* at climate control; any technology with that aim is almost by definition geo-engineering. Only technologies with climate *side effects* could possibly be less invasive, i.e., affect not the global but a regional climate. I doubt that these can exist, but if so – then, although, some states and individuals may not be directly affected freedom-wise, there will still be indirect effects for both. You cannot affect the climate in one place without affecting global economics and stability, and individual security and opportunities.

(3) Does what the advocates call ‘eco-quietism’, in other words letting nature run its course and retreating from interfering with nature, have different freedom effects? Let us first establish (again under the assumption that geo-engineering works) that eco-quietism is no longer a viable option, though for other reasons than the advocates assume: it is not a logically impossible position, but a politically irrational alternative. That said, eco-quietism or ecologism is predicated on the assumption that we can unlearn to value whatever ‘actions one can undertake’ that disappear when humans reduce their impact on nature. In other words: eco-quietism seriously reduces our effective freedom – but we can make ourselves (and others) believe that does not matter.

Sad but true: if one does not hate freedom, geo-engineering is worth consideration.

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¹⁷ A few rare exceptions: Bunzl 2011, Robock 2008.

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