The Far Future Argument for Confronting Catastrophic Threats to Humanity: Practical Significance and Alternatives

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Abstract
Sufficiently large catastrophes can affect human civilization into the far future: thousands, millions, or billions of years from now, or even longer. The far future argument says that people should confront catastrophic threats to humanity in order to improve the far future trajectory of human civilization. However, many people are not motivated to help the far future. They are concerned only with the near future, or only with themselves and their communities. This paper assesses the extent to which practical actions to confront catastrophic threats require support for the far future argument and proposes two alternative means of motivating actions. First, many catastrophes could occur in the near future; actions to confront them have near-future benefits. Second, many actions have co-benefits unrelated to catastrophes, and can be mainstreamed into established activities. Most actions, covering most of the total threat, can be motivated with one or both of these alternatives. However, some catastrophe-confronting actions can only be justified with reference to the far future. Attention to the far future can also sometimes inspire additional action. Confronting catastrophic threats best succeeds when it considers the specific practical actions to confront the threats and the various motivations people may have to take these actions.

Keywords: catastrophic threats; global catastrophic risk; existential risk; far future; co-benefits; mainstreaming

1. Introduction

Over several decades, scholars from a variety of fields have advanced an argument for confronting catastrophic threats to humanity, rooted in the far future benefits of doing so.[1] In this context, the far future can loosely be defined as anything beyond the next several millennia, but will often emphasize timescales of millions or billions of years, or even longer.[2] Likewise, the catastrophic threats in question—also known as global catastrophic risks (GCRs) and existential risks, among other things—are those that would affect the trajectory of human civilization over these timescales. The simplest case is catastrophes resulting in human extinction, which is a permanent result and thus affects the trajectory of human civilization into the far future. More subtle but comparably relevant cases include catastrophes resulting in the permanent collapse of human civilization, preventing humanity from ever achieving certain very great things, and catastrophes resulting in delays in the subsequent rise of civilization towards these achievements. The scholarship argues that people should care about human civilization into the far future, and

1 See Asimov (1979), Sagan (1983), Parfit (1984), Ng (1991), Tonn (1999), Ćirković (2002), Bostrom (2003), Matheny (2007), and Beckstead (2013) among others.

2 This definition of the far future is most explicitly stated in Beckstead (2013). In contrast, psychology and cognitive science research commonly defines "far future" in timescales of years (e.g., D'Argembeau et al. 2008; Ebert and Prelect 2007).

thus, to achieve far future benefits, should seek to confront these catastrophic threats. Call this the *far future argument* for confronting catastrophic threats to humanity.

In this paper, I will not dispute the basic validity of the far future argument. Indeed, I agree with it, and have advanced it repeatedly in my own work (Baum 2009; 2010; Maher and Baum 2013). Instead, I assess the extent to which the far future argument is necessary or helpful for actually confronting the threats. In other words, what is the practical significance of the far future argument? I also propose and assess two alternative approaches to confronting the threats. One alternative emphasizes near future benefits of avoiding near future catastrophes. The other alternative emphasizes other (unrelated) benefits of actions that also help confront the threats, creating opportunities even for people who have zero care about the threats.

It would be important if the threats can be confronted without the far future argument, because many people do not buy the argument. That people do not is suggested by a range of research. An extensive time discounting literature assess how much people value future costs and benefits. Most discounting studies use time scales of days to decades and focus on future benefits to oneself (Frederick et al. 2002); these studies are of limited relevance to valuations of the far future of human civilization. One more relevant time discounting study finds that people discount lives saved 20 years later at a 25% annual rate and lives saved 100 years later at an 8% annual rate (Johannesson and Johansson 1996); extrapolating this suggests negligible concern for lives saved in the far future. Similarly, Tonn et al. (2006, p.821) find that people believe humanity should plan mainly for the upcoming 20 years or so and should plan less for time periods over 1000 years. In a study on social discounting, Jones and Rachlin (2006) find that people are willing to forgo more money to help close friends and family than distant acquaintances; they presumably would forgo even less for members of far future generations. Finally, there are considerations rooted in how societies today are structured. Several researchers have argued that current electoral structures favor the short-term (Tonn 1996; Ekeli 2005; Wolfe 2008). Similarly, Karlsson (2005) suggests that the rise of decentralized capitalist/democratic political economies and the fall of authoritarian (notably communist) political economies has diminished major long-term planning. While none of these studies directly assess the extent to which people buy the far future argument, the studies all suggest that many people do not buy the argument to any significant degree.

To the extent that efforts to confront catastrophic threats can be made synergistic with what people already care about, a lot more can be done. This would seem to be an obvious point, but it has gone largely overlooked in prior research on catastrophic threats. One exception is Posner (2004), who argues that some actions to reduce the risk of human extinction can be justified even if only the current generation and its immediate successor are valued. Another is Baum (2015), who proposes to confront the threat of catastrophic nuclear winter in terms that could appeal to nuclear weapon states; Baum calls this “ethics with strategy”. But most of the prior research, including the studies cited above, emphasize the far future argument.

This paper expands Posner’s argument to further argue that some actions can be taken even for those who only care about their immediate communities or even just themselves. This paper also makes progress towards assessing the total practical significance of the far future by presenting a relatively comprehensive survey of GCRs and GCR-reducing actions. Such surveys are also scarce; one example is Leggett (2006), who surveys the space of GCRs to identify priorities for action. The present paper also has commonalities with Tonn and Stiefel (2014), who evaluate different levels of sacrifice that society should make in response to GCRs of different magnitude. The present paper also considers levels of sacrifice, but instead argues that, from a practical standpoint, it is better to start with those actions that require less sacrifice or are in other ways more desirable. Indeed, actions requiring large sacrifice may only be justifiable with reference to far future benefits.

The paper is organized as follows. Section 2 briefly reviews the space of GCRs. All actions to reduce the risk must help on one or more of these so as to result in a net risk reduction. The space of GCRs likewise provides an organizing framework for subsequent sections, as summarized in Table 1. Section 3 discusses the timing of GCRs. For catastrophes that could happen earlier, actions to avoid them will include the earlier benefits of catastrophe avoidance. Almost all GCR reduction actions have near-future GCR reduction benefits. Section 4 discusses co-benefits and mainstreaming of GCR reduction actions. Co-benefits are benefits unrelated to GCR reduction. Mainstreaming is integrating GCR reduction into established activities. Co-benefits and mainstreaming are both ways to facilitate GCR reduction for those who are not specifically motivated by the far future. Section 5 discusses GCR reduction actions that can only be justified in reference to the far-future benefits of GCR reduction. While these actions will typically not be the best place to start, they can play an important role in overall GCR reduction efforts. Section 6 discusses the ways in which attention to the far future can inspire additional GCR reduction action. This includes both analytical inspiration and emotional inspiration. Section 7 concludes.

GCR Category	Timing	Co-Benefits & Mainstreaming	High-Cost Actions
Environmental change	Near or Far	Money, health, happiness	Pollution abatement
Emerging technologies	Near Only	Other tech risks	Technology relinquishment
Large-scale violence	Near or Far	Money, small-scale violence	Increase in smaller conflicts
Pandemics	Near or Far	Other public health benefits	Aggressive quarantine
Natural disasters	Near or Far	Other disasters	Advanced refuges
Physics experiments	Near Only	Money	N/A
ET encounter	Near or Far	Science, entertainment	N/A
Unknowns	Near or Far	Other risks	Extraterrestrial time capsule

Table 1. Summary of global catastrophic risk categories (Section 2), their timing (Section 3), co-benefits and mainstreaming opportunities (Section 4), and high-cost GCR reduction actions that may only be justifiable with reference to far future benefits (Section 5). The co-benefits and mainstreaming opportunities and high-cost actions are illustrative examples, not complete listings.

2. The Global Catastrophic Risks

Which actions can help reduce the risk of global catastrophe depend on what the global catastrophic risks are in the first place. This section briefly overviews the risks. The risks have been described in more detail elsewhere (Asimov 1979; Leslie 1996; Rees 2003; Barrett 2007; Bostrom and Ćirković 2008; Tonn and MacGregor 2009; Jha 2011; Guterl 2012). While this section lists GCRs in distinct categories, the risks are often interconnected both within and across categories. For example, the emerging technology GCR of geoengineering is developed in response to the environmental change GCR of climate change, and the geoengineering risk is in turn affected by other GCRs such as large-scale violence or pandemics (Baum et al. 2013). Similarly, GCR reduction actions can often affect risks in multiple categories. So while the GCR reduction actions discusses in Sections 3-5 are organized in terms of the categories presented here, it should be understood that specific actions often spill across categories. All this suggests a systems approach to studying GCR.

Environmental change. By environmental change, I mean to refer to human-driven global environmental changes; natural disasters are discussed below. Climate change is perhaps the most commonly cited environmental change GCR; worst-case climate change scenarios attract considerable attention (e.g. Sherwood and Huber 2010). Other environmental change GCRs could include biodiversity loss, biogeochemical flows (interference with the nitrogen and phosphorus cycles), stratospheric ozone depletion, ocean acidification, global fresh water use, land use change, chemical pollution, and atmospheric aerosol loading (Rockström et al., 2009a, 2009b). While any of these phenomena could dramatically alter the global environment, it is less clear whether the impacts would be catastrophic for humanity (Raudsepp-Hearne et al. 2010; Baum and Handoh 2014). For this paper, it is important that many pro-environmental actions simultaneously help across a broad set of global environmental changes, lessening the need to distinguish which changes could be catastrophic for humanity.

Emerging technologies. Several emerging technologies could cause global catastrophe, including artificial intelligence (Eden et al. 2013; Bostrom 2014), biotechnology (Vogel 2013), geoengineering (Caldeira et al. 2013; Baum et al. 2013), and nanotechnology for atomically precise manufacturing (Drexler 2013). These risks are relatively uncertain given the unprecedented nature of emerging technology, but they may constitute a significant portion of total risk.

Large-scale violence. A sufficiently large global war could be catastrophic regardless of the technologies used—for comparison, hundreds of thousands died from attacks with machetes and other unmechanized weapons in the Rwandan genocide. Weapons of mass destruction make the job much easier. Nuclear weapons can be catastrophic both through direct explosions and the indirect effects of nuclear winter (Mills et al. 2014). Biological weapons can also readily cause global catastrophe, in particular if they are contagious; indeed, nonstate actors or even single individuals may be able to cause global catastrophes with engineered contagions (Rees 2003; Nouri and Chyba 2008). The pressures of conflict can also lead actors to take larger risks, as occurred during World War II when the Americans proceeded with the first nuclear weapon test despite concerns that it could ignite the atmosphere, killing everyone (Konopinski et al. 1946). Finally, major global violence could also result from an oppressive global totalitarian government (Caplan 2008).

Pandemics. Pandemics can be of natural or artificial origin, or both. Humans catch disease from the environment, in particular from other species. The development and transmission of zoonotic diseases can be enhanced by human activities including wild habitat destruction and factory farming. While it is clear that global pandemics can occur, their exact severity is a matter of ongoing analysis and debate (Germann et al. 2006; Koblentz 2009).

Natural disasters. Global catastrophes can result from several natural disasters including asteroid and comet impacts (Bucknam and Gold 2008; Sleep and Zahnle 1998), supervolcano eruptions (Rampino et al. 1988; Driscoll et al. 2012), solar storms (NRC 2008), and gamma ray bursts (Atri et al. 2013). While these natural disasters generally have lower probabilities, they nonetheless can be worth some effort to confront. Another natural disaster is the gradual warming of the Sun, which will (with very high probability) make Earth uninhabitable for humanity in a few billion years (O'Malley-James et al. 2014). Other long-term astronomical risks, such as the Milky Way collision with Andromeda (increasing the rate of dangerous supernovae) and the death of all stars (removing a major energy source) play out on similar or longer time scales (Adams 2008).

Physics experiments. Certain types of physics experiments have raised concerns that the experiments could go wrong, obliterating Earth and its vicinity. This notably includes high-energy particle physics experiments such as at the CERN Large Hadron Collider. Physicists evaluating this risk have argued that the risk is vanishingly small; however, they may be underestimating the risk by neglecting the possibility that their analysis is mistaken (Ord et al. 2010).

Extraterrestrial encounter. It is not presently known if there is any extraterrestrial life, let alone intelligent extraterrestrial civilizations. However, if extraterrestrial civilizations exist, then the result could be catastrophic for humanity (Michaud 2007; Baum et al. 2011). Non-civilization extraterrestrial life could also harm humanity with catastrophic contaminations (Conley and Rummel 2008).

Unknowns. There may be entire categories of GCR not yet identified.

3. The Timing of the Global Catastrophic Risks

If a global catastrophe could occur during the near future, then there will be near-future benefits to reducing the risk. The sooner the catastrophe could occur, the larger the near-future benefits would be. In general, it will be easiest to motivate action to confront the most imminent catastrophes—hence Posner's (2004) argument that much GCR-reducing action can be justified even if one only cares about the present generation and the next one to come. It is thus worth examining the timing of the catastrophes.

3.1 Specific Global Catastrophic Risks

Environmental change. Major environmental changes are already visible, with larger changes expected on time scales of decades to tens of millennia. Climate change is among the more long-term of these, with some impacts already visible, and the worst climatic effects contained within the next 25,000 years or so.[3] Another possible long-term environmental change is an oceanic anoxic event, which is caused by phosphorus runoff and would in turn cause major die-off of marine species. An oceanic anoxic event could occur on time scales of millennia (Handoh and Lenton 2003); more localized effects of phosphorus runoff are already visible.

Emerging technologies. Dangerous biotechnology already exists, and is steadily increasing in capability. Early design work for geoengineering is already underway, with deployments suggested to occur in upcoming decades (Keith et al. 2010). Experts give a significant probability to GCR-level artificial intelligence occurring within this century or next (Baum et al. 2011b; Müller and Bostrom 2014). Nanotechnology for atomically precise manufacturing may have similar time horizons.

Large-scale violence. Large-scale violence can happen at any time. The ongoing Ukraine crisis is a firm reminder that significant tensions linger between major nuclear weapons states. Nuclear war could even occur inadvertently, due to false alarm events that can occur at any time (Barrett et al. 2013). Risks from biological weapons could increase in upcoming decades as biotechnology advances. However, overall risk from large-scale violence may be gradually declining, following a general trend towards less violence (Pinker 2011) and an increasing sophistication of global peacekeeping capability (Goldstein 2011).

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[3] The 25,000 year figure is derived from Archer and Ganopolski (2005), Figure 3C, which shows a rapid temperature spike that declines most of the way back to current temperatures within 25,000 years and then remains at similar temperatures for another 500,000 years. However, this refers specifically to climatic effects; the human effects could persist longer, especially if the climate change causes a civilization-ending global catastrophe.

Pandemics. Pandemics can also break out at any time. Recent outbreaks of SARS, H5N1 and H1N1 flus, MERS, and currently Ebola have so far not reached a high degree of global lethality, but they are clear reminders that the threat of pandemics persists. Advances in biotechnology can lead to increasing risk through both intentional use and mishaps, as can increasing global connectivity. On the other hand, advances in public health can reduce the risk.

Natural disasters. Many natural disasters can also occur at any time. Risk from impact events, supervolcano eruptions, solar storms, and gamma ray bursts is roughly constant over long periods of time, into the far future. NASA's near-Earth objects survey has significantly reduced estimates of the risk of large impacts occurring over the next century or so (Harris 2008). Several astronomical risks, including the Sun's gradual warming, the Milky Way collision with Andromeda, and the death of all stars, are GCRs that exists exclusively in the far future.

Physics experiments. The risk from physics experiments depends critically on which physics experiments are conducted. The risk could increase as the capability to conduct experiments increases.

Extraterrestrial encounter. Humanity could encounter extraterrestrials at any time, including through ongoing searches for extraterrestrial intelligence (SETI). Some risk (especially contamination risk) comes mainly from human or robotic travel in space. Some risk comes from messaging to extraterrestrial intelligence (METI; Haqq-Misra et al. 2013). The timing of METI risk depends on the distance from Earth to the location being messaged. METI to sufficiently distant locations is another GCR that exists exclusively in the far future.

Unknowns. Unknown GCRs could occur in both the near and far future. Indeed, more future GCRs are less likely to be already identified.

3.2 Discussion

Relatively few identified GCRs exist exclusively in the far future: certain astronomical risks and METI to distant locations. For all other GCRs—and this constitutes almost all of the total identifiable risk—the catastrophes could occur in the near future. The identified risks from emerging technologies and physics experiments could only occur in the near future. The identified risks from environmental change, large-scale violence, pandemics, some natural disasters, some extraterrestrial encounter risks, and unknowns could occur in the near or far future. The preponderance of near future risks suggests that a lot of actions to reduce these risks can be done without reference to their far future benefits. On the other hand, these near future benefits may not always be enough, especially when the catastrophes would occur several decades or centuries later, as people often care little about even these earlier times. It is thus worth pursuing other means of motivating GCR reduction.

4. Co-Benefits And Mainstreaming GCR-Reducing Actions

Insight on how to motivate GCR reduction can be found from outside the core GCR literature, in some related literatures. The climate change mitigation community has developed the concept of *co-benefits*, defined as benefits besides the target goal (Hosking et al. 2011; Miyatsuka and Zusman, undated). For climate change mitigation, the target goal is greenhouse gas emissions reductions. Research assesses how communities can reduce their emissions while improving their economic development, public health, and wellbeing. The co-benefits concept readily applies GCR. Some actions to reduce GCR will also be profitable, fun, healthy, satisfying, safe, or otherwise desirable, often to those who perform the actions.

Similarly, the natural disaster management community has a robust practice of *mainstreaming* disaster management into established goals and procedures, especially those regarding development (Benson 2009; Twigg and Steiner 2002). Disaster management actions will often only be taken when they can be integrated into established goals and procedures; otherwise, the actions will be too impractical or undesirable. For example, urban design steps to reduce a town's vulnerability to hurricane storm surge can be mainstreamed into the town's broader urban planning processes (Frazier et al. 2010). GCR reduction actions can likewise also be mainstreamed into whatever people are already doing or trying to do.

The GCR reduction community would be wise to adopt the approaches of co-benefits and mainstreaming. Doing so requires an understanding of the co-benefits that can come from various GCR-reducing actions and the relevant established goals and procedures. For many of these actions—in particular those with sufficiently large co-benefits and well-established goals and procedures—reducing GCR can be a nice ancillary benefit of actions that might as well be taken anyway. For these actions, no concern for the far future is needed; often, no concern beyond one's immediate community is needed. These actions require the least sacrifice (indeed, it is a sacrifice not to take these actions) and likewise will often be the easiest actions to promote. This begs the question of which GCR-reducing actions have significant co-benefits and mainstreaming opportunities.

4.1 Specific Global Catastrophic Risks

Environmental change. Environmental change is largely driven by a wide variety of basic activities, including food consumption, transport, real estate development, and natural resource usage. More environmentally friendly actions can often be justified for non-environmental reasons. A recent study by McKinsey (Enkvist et al. 2007) found that many greenhouse gas emission reductions would result in net monetary benefits for those who reduce these emissions, especially in the realm of energy efficiency in buildings and transport. Happiness research has found that people rate their daily commute as being among their least happy activities (Layard 2003). Public health research links high-meat diets with obesity and other health problems (Pan et al. 2012). Buildings, transport, and food are meanwhile three of the most environmentally important sectors (USEIA 2011; Metz et al. 2007; Steinfeld et al. 2006). If significant changes in these sectors can be achieved for non-environmental reasons, the environmental benefit could be quite large.

Emerging technologies. It is often beneficial to develop regulations for multiple technologies at the same time, due to similarities between the technologies and the regulations (Kuzma and Priest 2010; Wilson 2013). Concerns about other technologies can thus motivate general technology regulation, which provides a framework for mainstreaming the regulation of emerging technologies GCRs. In addition, some actions specific to certain emerging technologies can have co-benefits. For example, one proposed solution to artificial intelligence risk is to design the AI to be "friendly" to humanity. In addition to not causing a catastrophe, such an AI could help with other societal problems (Muehlhauser and Bostrom 2014). If such an AI can be achieved with sufficient confidence, then this could be an attractive action even for those who are not concerned about AI risk.

Large-scale violence. Achieving peace avoids violence at all scales and also brings a variety of co-benefits. One co-benefit is economic growth—the so-called "peace dividend" (Ward and Davis 1992; Knight et al. 1996). Another co-benefit is psychological. Recent research finds that conflict is often driven by humiliation, and likewise that giving people a sense of dignity can help (Stern 2003; Lindner 2006). Finally, other research suggests that reducing domestic violence against women could lead to less interstate war (Hudson et al. 2012). Emphasizing these co-benefits could justify much action to reduce large-scale violence. Another worthy point of focus is violent nonstate actors, which continue to receive extensive attention in the wake of the 9-11 attacks. While nonstate actors may not be able to cause violence large enough to result in global catastrophe,[4] actions to confront them may have co-benefits and mainstreaming opportunities for large-scale violence. For example, the annual Nuclear Security Summits initiated by US President Barack Obama aim to prevent nonstate actors from acquiring nuclear weapons, but they also strengthen norms against nuclear weapon use more generally.

Pandemics. As noted above, there is some debate about how severe pandemics could be, including whether they would impact the far future. To a large extent, this debate is irrelevant. Regardless of how severe pandemics would be, there already exists a significant global public health infrastructure that responds to pandemics of all sizes. Improving this infrastructure can further improve the response. The case for improving this infrastructure is strengthened by the possibility of catastrophic pandemics, but the case is not dependent on this possibility (McKibbin and Sidorenko 2006).

Natural disasters. The GCR literature has proposed certain measures to increase society's resilience to a wide range of global catastrophes, including natural disasters. These measures include food stockpiles (Maher and Baum 2013), underground refuges (Jebari 2014), and space colonies and refuges (Abrams et al 2007; Shapiro 2009). These measures also tend to increase society's resilience to smaller catastrophes. Indeed, many actions taken to prepare for smaller catastrophes also benefit GCR reduction. In addition, while space colonies and refuges have been criticized for their high cost relative to other means of reducing global catastrophic risk (Sandberg et al. 2008; Baum 2009), some space missions are already underway or in planning for a variety of other reasons, including science, political prestige, and economic opportunity (e.g. in asteroid mining). Space colonies or refuges could be mainstreamed into these missions (Baum et al. 2014).

Physics experiments. Physics experiments are a curious case, because the relevant experiments are quite expensive (hundreds of millions to billions of dollars) and the social benefits somewhat limited. As Parson (2007, p.155) puts it, "this research is remote from practical application and serves largely to indulge national pride and the intellectual passion of a tiny elite group". Arguably, the co-benefits of reducing physics experiment risk include the money saved by not doing the experiments, and by tasking the money to a worthier cause, analogous to the peace dividend, though this is likely to be a controversial view among those who value the physics experiments.

Extraterrestrial encounter. Protection against extraterrestrial contamination has the co-benefit of protecting extraterrestrial environments from contamination by humans, which is of significant scientific value (Conley and Rummel 2008). The costs of SETI and METI are small relative to the big physics experiments, so while there are dollar savings to realize from skipping them, these are less of an issue. Perhaps the extraterrestrial-risk-reducing action with the most co-benefits would be research and public education into what the risks could be. Discussions of ETI are very popular, as seen in the extensive popular media and entertainment attention to ETI.

[4] Nuclear terrorism would likely be too small to cause a far-future-impacting global catastrophe, unless it catalyzed a large-scale interstate nuclear war (Ayson 2010). Biological terrorism could more readily cause a global catastrophe, as discussed above.

Unknowns. Actions likely to reduce unknown GCRs will typically be generic actions that also help reduce other GCRs or even smaller risks, such as building refuges (Jebari 2014) and stockpiling resources (Maher and Baum 2013).

4.2 Discussion

Many GCR-reducing actions, covering the full breadth of GCRs, have sizable co-benefits, and can also be mainstreamed into existing activities. Many of these actions will often be desirable even without reference to GCR, let alone to the far future benefits of GCR reduction. These "easy" actions will typically be the lowest hanging fruit, the easiest GCR reductions to promote. They offer a sensible starting point for those seeking to reduce GCR.

5. Actions With Significant Cost

Ideally, all GCR-reducing actions would have low costs and large co-benefits, such that it would be easy to persuade people to take the actions, and such that the totality of GCR could be reduced with minimal burden to those taking the actions and to society at large. As discussed above, many such actions exist. However, this is not the case for all GCR-reducing actions. Some of these other actions require considerable sacrifice, especially the most aggressive GCR-reduction efforts. Tonn and Stiefel's (2014) levels of societal actions are instructive here. The levels range from doing nothing to an extreme war footing in which society is organized specifically to reduce GCR. Actions requiring more sacrifice, especially those at or near the level of extreme war footing, might only be justifiable with reference to the far-future benefits. While these actions will typically not be the lowest hanging fruit, they could be important components of an overall portfolio of GCR-reducing actions.

5.1 Specific Global Catastrophic Risks

Environmental change. The most aggressive pro-environmental actions include public policies like a high carbon tax, personal behaviors requiring great inconvenience and sacrifice, and restructuring the entire global industrial economy away from fossil fuels and other pollutants. To achieve a larger reduction in environmental change GCR, some of these more aggressive actions may be needed. That these more aggressive actions may only be justifiable with reference to far-future benefits is a core point from debates about discounting in environmental policy (Nordhaus 2008).

Emerging technologies. One way to reduce emerging technology GCR is to simply abstain from developing the technologies, i.e., to relinquish them (Joy 2000). However, if these technologies do not cause catastrophe, they sometimes come with great benefits: geoengineering can avoid the worst effects of climate change; AI can solve a variety of social problems; biotechnology can help cure disease. Thus relinquishing the technologies can require a large sacrifice (Baum 2014). This sacrifice may sometimes only be justifiable given the far-future benefits of GCR reduction.

Large-scale violence. While nuclear weapons can cause great harm, they are also often attributed with helping maintain peace, through the doctrine of nuclear deterrence: countries hesitate to attack each other for fear of being destroyed in nuclear retaliation. There are questions about the efficacy of nuclear deterrence (Wilson 2013b) and there are proposals to achieve deterrence with out large nuclear arsenals (Baum 2015). However, a common view posits that nuclear deterrence is necessary until international relations are peaceful enough for a world without nuclear weapons (Obama 2009). Following this logic, immediate nuclear disarmament might reduce GCR, but it might also increase the preponderance of smaller conflicts and other geopolitical instabilities. Depending on the details, immediate nuclear disarmament might only be justifiable with reference to the far future.

Pandemics. One aggressive action to reduce pandemics risk would be aggressive quarantine, such as blockading the major islands of Indonesia, Japan, the United Kingdom, and other countries. Travel restrictions could keep populations in these places safe. During a sufficiently severe outbreak, populations in these places could even request to be blockaded. A safer but costlier and less desirable policy would blockade them at first alert of a possible outbreak, or even keep them blockaded on a permanent basis. Doing so might lower GCR, but might only be justifiable with reference to the far future.

Natural disasters. One proposed aggressive action for natural disasters could be to drill the ground around potential supervolcanoes to extract the heat, although the technological feasibility of this proposal has not yet been established.[5] This could be a very costly project, but, if it works, it could also reduce supervolcanoes GCR. The project would come with a co-benefit of geothermal energy, but this is likely not nearly enough to justify the expense. Another possibility is advanced surface-independent refuges, which could protect against a variety of GCRs, including many of the natural disasters, but again could come at great expense (Baum et al. 2014; Beckstead 2014).

Physics experiments and e*xtraterrestrial encounter*. I am not aware of any actions to reduce near-future GCR from physics experiments and extraterrestrial encounter that have significant cost and can only be justified with reference to far-future benefits. To the contrary, many actions to reduce these risks save money (Section 4.1). Protection against contamination does have a cost, and shutting METI programs down could cost the public a source of popular entertainment. On the other hand, the shut down itself could also create an entertaining controversy. Regardless, the costs involved are not large.

Unknowns. One action that might only be justifiable with reference to far future benefits is a far-future version of the "extraterrestrial time capsule" proposed in Baum et al. (2014). These capsules contain artifacts of benefit to catastrophe survivors for a range of known and unknown catastrophe scenarios. The capsules are launched into space in trajectories designed to return to Earth at some future date. Baum et al. (2014) suggest a return date 100 years into the future, but it may be possible (and expensive) to have return dates in the far future.

5.2 Discussion

For those who wish to keep humanity highly safe from catastrophe, there are actions that can only be justified with reference to the far-future benefits of GCR reduction. While these actions are typically not the best place to start, they can offer additional GCR reductions beyond what the easier actions offer. Given the enormous far-future benefits of GCR reduction, arguably these actions merit consideration. However, hopefully GCR can be essentially eliminated without resorting to these actions. If these actions are necessary, it will likewise be necessary to appeal to the importance of the far future.

6. Far Future As Inspiration

The paper thus far has focused on how to avoid appeals to the far future argument, in recognition of the fact that many people are not motivated by what will benefit the far future. But some GCR reduction actions can only be justified with reference to far future benefits. Additionally, some

[5] An idea to this effect is briefly discussed in Leggett (2006, p.794).

people are motivated to benefit the far future. Other people could be too. Tapping the inspirational power of the far future can enable more GCR reduction.

There are at least two ways that the far future can inspire action: analytical and emotional. Both are consistent with the far future argument, but the argument is typically inspired by analytical considerations. The analytical inspiration is found in works analyzing how to maximize the good or achieve related objectives. Most of the scholarly works invoking the far future argument are of this sort.[6] Such ideas have the potential to resonate not just with other scholars, but with people in other professions as well, and also the lay public. Thus there can be some value to disseminating analysis about the importance of the far future and its relation to GCR.

Analytical inspiration can also come from analyzing specific actions in terms of their far-future importance. Such analysis can help promote these actions, even if the actions could be justified without reference to the far future. However, the analysis should be careful to connect with actual decision makers, and not just evaluate hypothetically optimal actions that no one ever takes. For example, there has been now multiple decades of research analyzing what the optimal carbon tax should be (for an early work, see Nordhaus 1992), yet throughout this period, for most of the world, the actual carbon tax has been zero. Analytical inspiration has its limits. Research effort may be more productively spent on what policies and other actions people are actually willing to implement.

The other far future inspiration is emotional. The destruction of human civilization can itself be a wrenching emotional idea. In *The Fate of the Earth*, Jonathan Schell writes “The thought of cutting off life’s flow, of amputating this future, is so shocking, so alien to nature, and so contradictory to life’s impulse that we can scarcely entertain it before turning away in revulsion and disbelief” (Schell 1982/2000, p.154). In addition, there is a certain beauty to the idea of helping shape the entire arch of the narrative of humanity, or even the universe itself. People often find a sense of purpose and meaning in contributing to something bigger than themselves—and it does not get any bigger than this. Carl Sagan’s (1994) *Pale Blue Dot* and James Martin’s (2007) *The Meaning of the 21st Century* both capture this well, painting vivid pictures of the special place of humanity in the universe and the special opportunities people today have to make a difference of potentially cosmic significance.

This perspective says that humanity faces great challenges. It says that if these challenges are successfully met, then humanity can go on to some amazing achievements. It is a worthy perspective for integrating the far future into our lives, not just for our day-to-day actions but also for how we understand ourselves as human beings alive today. This may be worth something in its own right, but it can also have a practical value in motivating additional actions to confront catastrophic threats to humanity.

7. Conclusion

The far future argument is sound. The goal of helping the far future is a very worthy one, and helping the far future often means helping reduce the risk of those global catastrophes that could diminish the far-future success of human civilization. However, in practical terms, reducing this risk will not always require attention to its far-future significance. This is important because many people are not motivated to help the far future, but they could nonetheless be motivated to take actions that reduce GCR and in turn help the far future. They may do this because the

[6] See citations in Footnote 1.

actions reduce the risk of near-future GCRs, or because the actions have co-benefits unrelated to GCRs and can be mainstreamed into established activities.

This paper surveys GCRs and GCR-reducing actions in terms of how much these actions require support for the far future argument for confronting catastrophic threats to humanity. The analysis suggests that a large portion of total GCR, probably a large majority, can be reduced without reference to the far future and with reference to what people already care about, be it the near future or even more parochial concerns. These actions will often be the best to promote, achieving the largest GCR reduction relative to effort spent. On the other hand, some significant GCR reducing actions (especially those requiring large sacrifice) can only be justified with reference to their far-future benefits. For these actions in particular, it is important to emphasize how the far future can inspire action.

Several priorities for future research are apparent. Quantitative GCR analysis could help identify which actions best reduce GCR and also what portion of GCR can be reduced without reference to the far future. Analysis covering the breadth of GCRs would be especially helpful. Social scientific research could study how to effectively engage stakeholders so as to leverage co-benefits and mainstream GCR reductions into existing programs. Social scientific research could also examine how to effectively tap the inspirational power of the far future, especially for emotional inspiration, which has received limited prior attention. Progress in these research areas could go a long way towards identifying how to, in practice, achieve large GCR reductions.

The overall message of this paper is that helping the far future requires attention to which specific actions can help the far future and likewise to what can motivate these actions. The actions are not necessarily motivated by their far-future impact. This is fine. The far future does not care why people acted to help it—the far future only cares that it was helped. And people taking these actions will rarely mind that their actions also help the far future. Most people will probably view this as at least a nice ancillary benefit. Additionally, people will appreciate that those promoting the far future have taken the courtesy to consider what they care about and fit the far future into that. It can be disrespectful and counterproductive to expect people to drop everything they are doing just because some research concluded that the far future is more important. This means that those who seek to promote actions to benefit the far future must engage on an interpersonal level with the people who will take these actions, to understand what these people care about and how far-future-benefiting actions can fit in. This is an important task to pursue, given the enormity of what human civilization can accomplish from now into the far future.

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