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Nuclear Fine-Tuning and the Illusion of Teleology

By Ember Reed

Abstract

Recent existential-risk thinkers have noted that the analysis of the fine-tuning argument for God's existence, and the analysis of certain forms of existential risk, employ similar types of reasoning. This paper argues that insofar as the "many worlds objection" undermines the inference to God's existence from universal fine-tuning, then a similar many worlds objection undermines the inference that the historic risk of global nuclear catastrophe has been low from the lack of such a catastrophe has occurred in our world. A version of the fine-tuning argument applied to nuclear risk, The Nuclear Fine-Tuning Argument, utilizes the set of nuclear close calls to show that 1) conventional explanations fail to adequately explain how we have survived thus far and 2) the existence of many worlds provides an adequate explanation. This is because, if there are many worlds, observers are disproportionately more likely to reflect upon a world that hasn't had a global nuclear catastrophe than upon one that has had a global nuclear catastrophe. This selection bias results from the catastrophic nature of such an event. This argument extends generally to all global catastrophic risks that both A) have been historic threats and B) would result in a significantly lower global population.

Introduction

At 6:30 p.m. on September 18th, 1980, a wrench was dropped in rural Arkansas. The wrench fell 80 feet before colliding with a Titan II intercontinental ballistic missile

equipped with a nine-megaton nuclear warhead. This warhead, the largest in the US arsenal at the time, was identified by its designer as particularly unstable. At about 3:00 a.m. the following morning, as a lingering effect of the dropped wrench, the fuel cell exploded, launching the warhead into the sky.¹ The United States had launched a nuclear weapon.

Almost forty years later, Nick Bostrom would publish “The Vulnerable World Hypothesis,” which discusses the possibility of a technology being invented that puts all of humanity at risk. Notably, he places the possible discovery of an apocalyptic technology in the future.² This paper will put pressure on the assumption, common among authors who work in existential risk, that nuclear weapons as they exist in this world are not an apocalyptic technology. I will assume the multiverse hypothesis familiar from contemporary physics and from objections to the fine-tuning argument for God. According to the hypothesis, there exist multiple worlds. I will attempt to show that, if there are alternate versions of Earth, a significant percentage of alternate Earths experienced a global nuclear catastrophe before the current year. Mirroring arguments that attempt to show that the existence of other universes would undercut the inference from universal fine-tuning to God, I will show that the existence of other universes undercuts the inference from nuclear fine-tuning to relative nuclear stability.

Section 1 will give a brief history of teleological arguments for God’s existence, focusing specifically on fine-tuning arguments, and will introduce the concept of anthropic coincidences. Section 2 will discuss the set of nuclear anthropic coincidences and will show how a many-worlds view explains these coincidences. Section 3 will discuss alternative explanations and will show how each fails to explain the

coincidences. Finally, Section 4 will discuss other possible objections to the many-worlds interpretation of nuclear fine-tuning.

Section 1: A Brief History of Teleological Argument

Before we get to the nuclear fine-tuning argument, I'm going to use this section to set the stage for our later discussion by reviewing many of the moves made in other fine-tuning arguments. Fine-tuning arguments are a subset of the many teleological arguments for God's existence. In general, teleological arguments for God attempt to find empirical evidence for design and then infer from this evidence the existence of an intelligent designer. This section will begin by discussing biological teleological arguments and how the discovery of Darwinian evolution acted as a defeater for those arguments. Then I will discuss the fine-tuning argument. In discussing these arguments I will talk about how the existence of other universes if verified, would defeat the argument from universal fine-tuning. This section will conclude by introducing the nuclear fine-tuning argument as an argument that is analogous to other fine-tuning arguments.

Historically, perhaps the most familiar form of teleological argument has focused on *biology*. Such arguments look at how certain biological organs, like the heart, function in ways that are similar to an intricate machine, like a watch.³ Biological teleological arguments contend that this functionality is unlikely to arise through chance, and therefore the functionality of living things is evidence of an intelligent designer. Just like a watch, living creatures have many parts that are necessary to their functioning; it is not merely that we possess a single organ that is particularly intricate, but rather that

every part of the human body, or of any other biological system for that matter, is impossibly complex. As a result, without a unified explanation, each additional contingency makes the existence of complex forms of life appear even more implausible. The design argument is compelling in this instance because it is necessarily implausible that a species would just happen to have the entire set of traits necessary to its survival if the possession of any one of these traits is determined independently from all other traits.

The discovery of Darwinian evolution is generally understood to have undercut versions of the teleological argument that leverage the particular functionality of biological systems.⁴ This is because Darwinian evolution provides an alternative unified explanation for why biological life is so intricate, without appealing to blind luck or expanding our ontology.

But even if the rise of Darwin has led to the demise of teleological arguments based in biology, at the same time there has been a rise of teleological arguments based in *physics*—this is the fine-tuning argument.⁵ In the first half of the twentieth century, the fine-tuning argument focused on the apparent fine-tuning of our home planet. For example, if earth's orbit around the sun did not happen to be within the “Goldilocks zone”⁶, then liquid water would not exist on earth and life could not have formed. Just as the teleological argument grounded in biology appeals not to one, but to many contingencies to make the case for intelligent design, the fine-tuned planet version of the fine-tuning argument appeals to the many contingencies upon which life on earth depends—not to a single contingency—as support for God's existence.⁷ The intuition being that if God existed God would place earth within the goldilocks zone,

because they desired to create a world that includes life. Defenders of the God hypothesis have argued that, because the God hypothesis provides a unified explanation for what otherwise seems like a set of anthropic coincidences—i.e., cases that make our current existence seem unlikely—these coincidences increase the probability of the God hypothesis being true.⁸ However, the discovery of planets outside of our solar system undercuts the plausibility of this interpretation.⁹ The numerous exo-planets inhospitable to life show that there isn't some universal law that ensures that planets are life-friendly.¹⁰

Ever since the discovery of planets beyond our solar system, Teleological arguments for God's existence tend to focus on universal fine-tuning. Such arguments focus on the immense number of seeming contingencies relating to universal constraints, the conditions in the early universe, and the set of physical laws. For example, if the strength of gravity relative to electromagnetism had been significantly weaker, galaxies, stars, and planets never would have formed; if it had been slightly weaker, stars wouldn't explode in supernovae, which is the main source of heavy elements in the universe; on the other hand, if gravity had been slightly stronger, stars would form from less matter and, as a result, would have shorter lifespans.¹¹ Again these anthropic coincidences have been used as evidence for the God hypothesis.

However, if there are multiple universes, these anthropic coincidences wouldn't support the God hypothesis. Just as in the case of earth's apparent fine-tuning, the existence of other universes, which are inhospitable to life, would show that universes aren't necessarily habitable.

While fine-tuning arguments have traditionally rooted themselves in physics, this style of argument can be built around any set of anthropic coincidences. The rest of this paper will leverage the set of nuclear close calls during the Cold War as the basis for a version of the fine-tuning argument, henceforth referred to as the Nuclear Fine-Tuning argument, rooted in history (the history of nuclear close calls) rather than physics. As in the other cases, the most common interpretation of how we thus far avoided a global nuclear catastrophe is teleological, defending the assumption that the systems that control nuclear arms (nuclear treaties, MAD doctrine, etc.) are intelligently designed—that is, designed with foresight in order to bring about a certain plan, in which nuclear annihilation is avoided. A defender of this argument would say that our avoiding a nuclear war thus far is evidence that favors the view that the nuclear doctrines used by states to dictate how they manage their nuclear weapons are sufficient to avoid cataclysm. Yet the specifics of many nuclear close calls put pressure on many conventional interpretations.

As in the other arguments, the particulars initially seem to be non-natural. General Lee Butler, former head of the U.S. Strategic Command -- which controls nuclear weapons and strategy -- wrote that “we escaped the cold war without a nuclear holocaust `by some combination of skill, luck, and divine intervention, and [he] suspect[ed] the latter in greatest proportion”.¹² While this theistic interpretation of nuclear fine-tuning is closely analogous to the others we have considered, it differs in that the relevant anthropic coincidences surround humanity's current existence rather than its entire historical existence. Accordingly, theistic interpretations of this set of anthropic coincidences would have to posit a God invested in the particulars of human

affairs. On the other hand, the many-worlds interpretation gives a unified explanation of both universal fine-tuning and nuclear fine-tuning. This is because if there are enough universes every possible outcome should happen somewhere.

The existence of many worlds is controversial; however, for this paper, I would like to take their existence as a premise. Insofar as the existence of many worlds would defeat the fine-tuning argument for God's existence, what effect might it have on our interpretations of other anthropic coincidences? The next section of this paper will provide an interpretation of nuclear close calls that assumes the existence of many worlds.

Section 2: The Nuclear Fine-Tuning Argument

Let us return to Arkansas 1980, on September 19th, just after 3 a.m. The nine-megaton warhead, the largest in the US arsenal at the time, the one noted to be particularly unstable by its creator, fell back to earth, crashing into the ground a few hundred feet from the launch complex's entry gate. Fortunately, it did not detonate.¹³ Just how fortunate it is hard to say. For this paper, let's suppose that there was a 50% chance of the Damascus missile explosion leading to a nuclear detonation and that an unplanned nuclear detonation on American soil would have led to a global nuclear catastrophe. A single anthropic coincidence isn't, on its own, noteworthy. Sometimes things do work out for the best. Sometimes the nuclear coin lands heads and so we all survive. Yet the Damascus Titan missile explosion is not the only example of our good fortune.

This section will begin by outlining several more cases where nuclear catastrophe was avoided by some amount of chance or luck. It will then discuss how the existence of many universes would mean that our positionality as observers would help to explain why a nuclear war between the United States and the Soviet Union didn't occur. It will proceed by first discussing a general case and then applying that general case to the specific case of a global nuclear catastrophe.

On January 23rd, 1961, a B-52 bomber carrying two nuclear warheads crashed over North Carolina. The first bomb, which descended by parachute, was found in a tree. The other bomb, which lacked a parachute, plunged into farmland at 700 miles per hour and disintegrated without the detonation of its conventional explosives. Both bombs were partially armed when they left the aircraft.¹⁴

On October 27th, 1962, the American military trapped the Nuclear-armed USSR Submarine B-59 off the coast of Cuba and made the potentially world-ending decision to fire upon the sub. The vast majority of the crew on the Soviet sub wanted to return fire, making use of the nuclear torpedo. Captain Vasili Arkhipov was the lone dissenting voice on the Soviet side: the sole figure who prevented the firing of the nuclear weapons.¹⁵

On January 25th, 1995, the trajectory of a U.S.-Norwegian rocket carrying scientific equipment resembled the path of a nuclear missile. As a result, Russian President Boris Yeltsin had to decide whether or not to fire a retaliatory nuclear strike on the United States, ultimately deciding not to fire.¹⁶

Due to it being impossible to know the real probability of any cases leading to a nuclear exchange between the United States and the Soviet Union, I am going to treat

each of them as a straight coin flip. The chance of four consecutive coin flips coming up heads is 6.25%. Some readers might dispute the assumption that the risk in each of these cases is 50%, and indeed, while the risk in these cases might have been greater, they might also have been less risky than I'm making them out to be. However, this risk assessment also ignores an uncountable number of other cases. Nuclear risk is of course not limited to these few moments. While there has never been an accidental nuclear detonation on American soil, there have been thousands of nuclear accidents.¹⁷ Additionally, While these moments show how the doctrine of nuclear deterrence leads to moments where humanity risks accidental armageddon, it does not capture the risk of intentional nuclear war. For the sake of argument, let us say that there was a 95% chance of a global nuclear catastrophe occurring before 2020.

Regardless of how likely one thinks nuclear war between the United States and the Soviet Union was during the second half of the twentieth century, luck must play some explanatory role—unless one believes there was zero risk. If there are many worlds, however, what luck means in this context fundamentally changes. We did, in this world get lucky, but we were unlikely to be persons within the broader set of worlds who didn't get lucky—because most people die if there's a global nuclear catastrophe. This is to say that 1) from the standpoint of this world, global nuclear catastrophe was averted in large part due to random chance, and 2) in many other worlds, different possibilities manifested which led to nuclear catastrophe, but 3) a disproportionate number of people live in worlds in which a global nuclear war did not occur.

Imagine that there is only one world. If this world faces nuclear close call after nuclear close call, at some point its repeated good fortune cries out for explanation: it is

unlikely for every coin toss to go our way. Perhaps it was divine intervention, perhaps something else, but it becomes increasingly unlikely that it is just luck time after time after time.

Now let us imagine that there are many worlds, an arbitrarily large number of which at certain points in time a total nuclear war could occur. Even if, in half of the worlds, say, the first close call leads to cataclysm, and in half of the remaining worlds, the second close call leads to cataclysm, that still leaves many worlds without global nuclear catastrophe. If we accept that there are in fact many worlds, a world avoiding nuclear catastrophe merely on the basis of luck seems much more tenable if there are many worlds than if there is only one world. In the same way, someone flipping 10 heads in a row merely on the basis of luck if there are many people flipping coins than if there is only one. Additionally, the existence of multiple worlds can do even more explanatory work once we consider what type of world one is likely to find themselves on.

People are not evenly distributed throughout time and space. For example, we do not find it surprising that we inhabit Earth rather than Mars. At the same time, if there had been a global nuclear catastrophe, Earth's population would be lower. As a result, the chance of a random person within a set of worlds being in a world where a particular event took place (Y) is non-identical to the chance of that event taking place in a world within the given set (X). This is because, if an event is correlated with a change in the population, persons are more likely to live in worlds where events correlated with a higher population take place at a disproportionate rate. This is due to the number of

people living in various worlds. Inversely, people live in worlds where events correlated with a lower population took place at a disproportionately low rate.

To greatly simplify, let us imagine that all persons live on one of two volcanic islands. In the immediate past, island A erupted; island B has not had a recent eruption. First let us imagine that everyone on island A died and, as a result, A has a population of 0 while B has a population of 20.¹⁸ In this case, while the probability that an island has had an eruption in the immediate past is $\frac{1}{2}$, 0% of persons live on such an island. Next, let us imagine that the eruption is a little less deadly, and say that A has a population of 10 while B has a population of 20. Here, while the probability of an island having had an eruption is $\frac{1}{2}$, in this version of the case the probability of being a person living on an island that had an eruption, in the immediate past, is $\frac{1}{3}$.¹⁹ As a result, one should not find it surprising to be living on an island that hasn't had a volcanic eruption. The formula below allows conversion between these two types of probability, Y being the probability of an event being in one history, X being the probability of having an event occurring, A being the mean population of worlds within the set where the event occurs and B being the mean population of worlds in which the event doesn't occur:

$$Y = \frac{AX}{(AX)+(BX')}$$

To apply this logic to nuclear close calls, we first need a best guess about what a nuclear war between the United States and the Soviet Union might look like. It is pretty clear that such a conflict would be disastrous, and that such a war would greatly reduce the global population. First, there would be tens of millions killed by the bombs themselves.²⁰ Then there would be hundreds of millions of excess deaths caused by the evisceration of infrastructure in the participating countries.²¹ Finally, there would be billions of excess deaths resulting from the environmental and macroeconomic effects

of the war.²² While such a war might well lead to human extinction, for this paper I am going to treat such a conflict as decreasing the population by 95%. For the sake of simplicity, I am going to treat worlds that have had a global nuclear catastrophe as having 5% of the population of this world for any given year.

If a global nuclear catastrophe would decrease the population by 95% and 50% of worlds have a global nuclear catastrophe then 95% of persons (living in the 2020s) would be living in worlds like ours, where a global nuclear catastrophe has not occurred. Most people living in the 2020s would be living in worlds that have not had a global nuclear catastrophe up until the point that global nuclear catastrophe occurs in more than 95% of worlds. In other words, it is our position as observers which explains why we don't see a global nuclear catastrophe in our history despite it being extremely likely for such a war to take place.

Section 3: Alternative Interpretations

It is possible that the Nuclear Fine-Tuning argument doesn't actually apply to nuclear risk. Just as the verified existence of an intelligent designer would make the existence of many worlds irrelevant to the explanation of universal fine-tuning; if another explanation explains why none of the nuclear close calls resulted in a cataclysm then we wouldn't have reason to believe that other worlds suffered a global nuclear catastrophe. Generally, there are two leading types of explanations used to account for the lack of global nuclear catastrophe: deterrence theory and high safety standards. Regardless of its form, a conventional explanation would need to show that evidence, such as that provided in this paper, that seems to indicate that the probability of global

nuclear catastrophe has historically been extremely high, is in fact misleading evidence. Just like in the case of universal fine-tuning, God might also act as a unified explanation. First I will discuss how the many worlds explanation undercuts standard interpretations. I will discuss the advantages and disadvantages of such explanations. Ultimately it seems that standard interpretations are not fully explanatory.

In standard cases, the historical record can give us a sense of what effect a particular policy, if implemented, is likely to have. For example, if one wanted to know the effects of a particular tax policy, one could look at various countries that have implemented such a policy and examine the outcomes. This remains true regardless of the number of worlds, and so there is no argument from the multiverse hypothesis as a premise to the conclusion that we cannot predict what the effect of the tax policy would be in our own country. However, this style of investigation cannot tell us the effectiveness of nuclear-deterrence policies such as M.A.D. (Mutually Assured Destruction). This is because, even if nuclear deterrence leads to global catastrophe before the 2020s in many worlds, persons studying nuclear deterrence are likely to be within the 5% of worlds where global nuclear catastrophe doesn't take place. As a result, the empirical data will always show that the policy is effective, regardless of its actual effectiveness.

This does not mean of course that the adoption of nuclear deterrence measures and particular safety standards around the use of nuclear weapons couldn't explain the absence of a global nuclear catastrophe; it simply means that the effects of such policies cannot be known merely through their historic outcomes. Rather, it is necessary to recognize that selection bias may be at work in cases that seem to involve anthropic

coincidence and, in such cases, to extend our analyses to include the sequence of events that might lead to certain effects. This suggestion is in line with Martin E. Hellman's observation, in his paper "Risk Analysis of Nuclear Deterrence," that "estimating the failure rate of nuclear deterrence has similarities with estimating the failure rate of a nuclear reactor design that has not yet failed. In addition to estimating the failure rate, such a study also identifies the most likely event sequences that result in catastrophic failure." As a result, we must examine if these explanations explain why none of the close calls lead to a global nuclear catastrophe.

Efforts to maintain nuclear-weapons safety explain, at least in part, why there haven't been more nuclear accidents. In the case of the 1961 Goldsboro B-52 crash, the safety mechanisms on the bombs themselves did prevent their detonation. However, despite the absence of a detonation this case does boost my confidence in this explanation. A declassified report on first the first bomb notes that it "did not possess adequate safety for the airborne alert role on the B-52."²³ Additionally, in the case of both bombs, the safety mechanism was not properly utilized. For the first bomb, which descended by parachute, A single switch, out of four safety mechanisms, prevented its detonation. The other bomb, which lacked a parachute, was partially armed when it left the aircraft. Its arm/safe switch was found in the arm position. While efforts made to make these weapons more safe were well worth the effort; they do not account for the totality of anthropic coincidence.

The Nuclear Fine-Tuning Argument doesn't entail that any attempts to avoid a nuclear war are ineffective. Nuclear deterrence may be part of the explanation for how we have thus far avoided a nuclear exchange. Insofar as nuclear wars are unwinnable;

nuclear states acting in their own best interest should never fire the first strike. Any explanation of why there hasn't been a global nuclear catastrophe must take this fact into account. For example, deterrence does a great job of explaining why neither the US nor the USSR decided to attempt a first strike at any point during the Cold War. However, this explanation only partially explains the phenomenon. While deterrence is a highly relevant factor in many close calls; for example, Captain Vasili Arkhipov's decision to not fire a nuclear torpedo was informed by his understanding of what such an action would have meant, it is not a complete explanation. The vested interest of states and persons to not fire nuclear weapons doesn't fully explain this case. First of all the conditions on the sub weren't ideal for rational decision-making. According to Second Retired V.P. Orlov²⁴ who was the commander of the special assignment group on the sub,

“the accumulators on B-59 were discharged in a state of water, only emergency lights [were] functioning. The temperature in the compartments was 45-50 C up to 60 in the engine compartment. It was unbearably stuffy. The level of CO₂ in the air reached a critical, particularly deadly mark.” Additionally the crew of the sub wasn't sure in what context they were forced to make their decisions, with one officer remarking “maybe the war has already started up there.”

While the possibility of nuclear armageddon remains a good reason for not wanting to fire, there were many compelling reasons for them to fire with that same officer saying at the time, “We're going to blast them now! We will die but we will sink them all! We will not disgrace our navy!”

A defender of the deterrence hypothesis could say that even in these conditions deterrence is still a sufficient explanation; despite all of these conditions being reasons to use nuclear arms, the threat of deterrence still outweighs them all. Yet this fails to consider that everyone else on board besides Captain Vasili Arkhipov wanted to fire, in

order for deterrence to fully explain cases like this it would need to be impossible for anyone to want to fire a nuclear weapon. If it was possible for the sub to return fire, then there is some degree of anthropic coincidence. Furthermore, given that his opposition to firing the weapon was unique among the crew, in order to maintain that the missile was unlikely to be fired in this case, one would need to maintain Arkhipov's disposition was typical of those on USSR nuclear subs, in 1962, while the crew of the B-59 was particularly willing to fire a nuclear torpedo.

Assuming that deterrence necessitates never firing a nuclear missile under any circumstance does explain some other cases. Boris Yeltsin's decision to not fire in 1995 is explained through this framework. However, such an assumption undermines the principle of deterrence itself. Consider Second Lieutenant Allan D. Childers, the commander of a Titan II missile combat crew at the little rock air force base. Eric Schlosser notes that "Childers had faith in the logic of nuclear deterrence: his willingness to launch the missile ensured that it would never be launched."²⁵ We cannot have it both ways. If it is always irrational to fire a nuclear missile, due to deterrence, then the logic of deterrence fails and first strikes come back onto the table. On the other hand, if a retaliatory strike is rational, then deterrence doesn't explain cases in which a person believed they would be firing a retaliatory strike.

As in the case of universal fine-tuning, the God hypothesis could be used to fill the explanatory gap. In the case of fine-tuning the argument goes: 1) it is unlikely for our universe to be life-friendly; 2) God, if they existed, would ensure that our universe was life-friendly; therefore, 3) our universe being life-friendly is evidence for God's existence. However, such an explanation lacks any predictive ability, and additionally, it creates

more questions than it answers. If God doesn't want there to be a nuclear catastrophe, why do nuclear weapons even exist, and how was the US able to drop two nuclear bombs on Japan during the second world war? Perhaps God only cares for America, but, if this is the case, why is American infrastructure terrible? Perhaps God works in mysterious ways; yet, if her ways are truly unintelligible, we must look for explanations elsewhere.

All of these alternative explanations ultimately fail to fully explain the set of anthropic coincidences. Of course, the nuclear fine-tuning argument might still fail to explain the historical record. In the next section, I will raise possible objections to my previous argument and respond to each in turn.

Section 4: Objections and Responses

I am sure that much of what I have said in this paper will be extremely controversial. This section will serve to make clear my position and respond to some possible objections to it. First I will discuss the relationship that my argument has to something known as the “self-sampling assumption.” Then I will discuss concerns regarding the reference class used in the nuclear fine-tuning argument. Finally, I will explain how some of the seemingly counterintuitive results of my argument are, in fact, perfectly intuitive.

All Anthropic theories that currently exist are controversial and it might seem like this argument requires me to rely on one, thus committing me to a controversial principle. For example the self-sampling assumption, each observer-moment should reason as if it were randomly selected from the class of all observer-moments in its reference class,²⁶ This is controversial, partly because it entails the Doomsday Argument, a probabilistic argument that seeks to show that the end of the world is near due to the improbability of being born now if there will be far more people in the future.²⁷ Fortunately, the nuclear fine-tuning argument does not require me to take a stance on the self-sampling assumption. Rather, the argument as laid out in this paper relies only on the much weaker assumption that whatever the correct anthropic theory is it will be one under which the existence of many universes would undermine the teleological interpretation of Universal Fine Tuning; this is not a controversial assumption.

Turning to another point, some objections may focus on the reference class used in the fine-tuning nuclear argument. In my argument, I maintain a reference class of

humans living in worlds that were identical up until the precise moment of the Trinity Test, living in the 2020s. This is distinct from the universal fine-tuning argument, which takes the observer class to be life in general. One could maintain that one who exists in a particular world could not exist in another world, and therefore persons in other worlds must be part of different reference classes. However, I find such a position unconvincing. If, while sleeping, a person was swapped with their counterpart in another world indistinguishable from their own, except for the conditions of stars lightyears away, they couldn't possibly discover the change in their world. As a result, from one's subjective perspective, one could be in any number of worlds.

On the other hand, others might argue that this reference class is too restrictive, that one could be a person living in another time, and that, if the nuclear fine-tuning argument holds, we should find it surprising that we are living in the 2020s, a full eight decades after the Trinity Test. I'll just grant that one could be in another time, this is true to some degree. However, it isn't that surprising. If we assume that global nuclear catastrophe is the only relevant factor and that 95% of world's experience a global nuclear catastrophe that eliminates 95% of the population before 2020, then the mean population of worlds in 2020 is .78 billion. On the other hand, given that 0% of worlds experience a global nuclear catastrophe before 1820, the mean population of worlds in 1820 is 1 billion. So there still wouldn't be that many more people living in the 19th century than in the 21st. As a result, the argument still holds if people from all times are included in the reference class. If one hundred years pass without either a reduction in nuclear risk or a global nuclear catastrophe, this particular argument will hold more

weight. However, since this objection suffers from problems similar to those facing the next objection, it will be resolved in the next paragraph.

Some consequences of this argument might seem counterintuitive. For example, by this argument, if a given person lives in a world destroyed by global nuclear catastrophe, as opposed to a world that hasn't had a global nuclear catastrophe, they should find this fact surprising. However, the counterintuitive ring of this objection flows from how it has been framed. As stated, the objection merely reframes the idea that one should find it surprising to have survived a global nuclear catastrophe. I would be shocked to survive such a conflict, so I happily concede the objection as so stated. Similarly, the second objection gets stronger over time only because, as time passes, it gets more surprising that there hasn't been a global nuclear catastrophe.

Conclusion

If there are many worlds, then many of them have been destroyed by nuclear fire. In the same way that the existence of many worlds undercuts the inference to God from universal fine-tuning, it also undercuts the inference from our survival thus far to global nuclear catastrophe being unlikely. This is because, insofar as no one lives in universes where life is impossible, few people live after nuclear armageddon. The existence of other worlds provides the only unified explanation for the set of anthropic coincidences surrounding nuclear weapons. Alternative explanations either fail to address the totality of coincidence or, in the case of divine intervention, could explain any conceivable set of events, and as a result, explain nothing. As a result, we should take the threat of global nuclear catastrophe extremely seriously.

As I write, Russia is attempting to leverage the threat of nuclear war to gain control of Ukraine. The entire world holds its breath as the task of avoiding a global nuclear catastrophe is shifted to the United States and her allies. This is not the first time that our world has teetered on the brink of nuclear armageddon – but, for many worlds, it will be the last.

I asked a Rabbi what to do, and he sent me a love poem composed by a contemporary environmentalist. I hope that this paper does not lead its reader to simply wait for the bombs to fall. Ayisha Siddiqa's poem "On Another Panel About Climate, They Ask Me to Sell the Future and All I've Got is a Love Poem" compels me to gamble on humanity:

"How rare and beautiful it is that we exist.

What if we stun existence one more time?"²⁸

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Endnotes

1. Christ(2020)
2. Bostrom(2019)
3. Classic discussions include Paley's Natural theology (1802) and Hume's *Concerning Natural Religion* (1779)
4. Friederich (2019: 36)
5. Joseph (1913)
6. Between .95 and 1.67 AU Koppurapu(2013).
7. Joseph (1913)
8. For example Swinburne(2010: 223--233)
9. The first exo-planet was discovered in 1992.
10. Friederich (2019: 35)
11. Barnes (2013: 33-34)
12. Butler, Lee. "Address to the Canadian Network Against Nuclear Weapons." Montreal, Canada, 11 March 1999.
13. Christ(2020)
14. Jones
15. Mozgovi(2002)
16. Hoffman(1988)
17. *Schlosser* (2013: 327)
18. Necessarily, if both islands have volcanic eruptions, then everyone will be living on an island that has had a recent volcanic eruption.
19. This thought experiment was inspired by Nick Bostrom's The Incubator Gedanken thought experiment as outlined in *Observation Selection Effects in Science and Philosophy*.
20. "There would be more than 90 million people dead and injured within the first few hours of the conflict." Glaser(2019)
21. The collapse of the US power grid would result in the death of 90% of the population "through starvation, disease, and societal collapse" Pry(2015)
22. The entire world would experience a nuclear winter: the smoke created by the weapons would cause unprecedented surface darkening, a significant drop in surface temperatures, and large disturbances in the global climate alter local weather patterns. This would all result in global agricultural capacity being significantly diminished. Turco(1983)
23. Jones
24. Mozgovi(2002)
25. *Schlosser* (2002: 11)
26. Bostrom (2001: 3)
27. Brandon(1983)
28. Siddiq 8-9