The Martingale Multiverse

How The Multiverse Accounts For *This* Fine Tuned Universe

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Abstract

This paper will attempt to offer a defence of to the Multiverse (MV) hypotheses, in the context of the theistic Fine Tuning Argument (FTA). It will be argued that theistic proponents of the FTA who argue that the MV hypothesis commits the Inverse Gambler's Fallacy (IGF) are, themselves, guilty of moving the goalposts when it comes to assessing the validity of the MV hypothesis. The Cosmic Slot Machine analogy will be used to demonstrate how the This Universe Objection (TUO), first outlined by White (2000) and further clarified by Draper et al (2007), fails to adequately account for the anthropic principle (or selection effect).

Introduction

"It would seem that this universe, our universe, is delicately fine-tuned for the existence of life; for life to emerge in our universe the fundamental constants could not have been more than a few percent from their actual values" (Vuyst, 2020). But what can we infer from this astonishing fact? Can we infer anything at all? Proponents of the Fine-Tuning Argument (FTA) argue that "given fine-tuning of the Universe, the existence of a life-permitting universe (LPU) is very unexpected given naturalism (i.e. the view that there is only one world, the natural world . . . which evolves according to unbroken patterns, the laws of nature) but not particularly unexpected given theism (i.e the view that God exists). It thus provides evidence for the existence of God" (Barnes, 2020). Barnes, among others, has attempted to build an argument along the lines of a Bayesian inference[1] to demonstrate why the theistic conclusion is more probable. While some naturalists agree that the FTA is the strongest argument in favour of the existence of God, a number of objections have been raised. Among the strongest of these is what Robin Collins refers

[1] Bayesian inference is an important technique in statistics often used in physics. It is a method of statistical inference in which Bayes' theorem is used to update the probability for a hypothesis as more evidence or information becomes available

to as the Naturalistic Single Universe (NSU): "the hypothesis that there is only one universe, the existence of which is an unexplained, brute given" (Collins, 2009). A related objection would be what Luke Barnes refers to as "Deeper Laws", i.e. the view that "the constants and initial conditions simply reflect the unfinished state of current physics. Physics will progress until we find, in the words of Einstein, 'such strongly determined laws that within these laws only rationally completely determined constants occur (not constants, therefore, whose numerical value could be changed without destroying the theory)" (Barnes, 2020). In other words, it is the idea that scientists will arrive at a final model of the Universe which doesn't require fine-tuned parameters, rather the values for the fundamental constants will be necessitated by these "deeper laws". An alternative hypothesis, "which has appealed most to scientists of recent years" (Swinburne, 2012), is the Multiverse hypothesis: "[t]he claim is that there are innumerable universes (jointly forming a 'Multiverse'), each having its own 'constants' of nature and its own initial conditions, so that, unlikely as the life-inducing values of these constants and conditions in our universe may be, they simply must occur within this unfathomable plurality" (Landsman, 2016). These two positions can be classified under the wider umbrella of "Metaphysical Naturalism" (Mahner, 2016).

In his book, *The Hidden Reality*, theoretical physicist Brian Greene explains "nine different multiverse" proposals (Ellis, 2011): quilted, inflationary, brane, cyclic, landscape, quantum, holographic, simulated, and ultimate. However, it is the broader MV hypothesis whcih will be discussed here – any model proposing an "unfathomable plurality" of universes.

Inverse Gambler's Fallacy

Proponents of the theistic FTA are not alone in declaring the existence of our fine-tuned universe improbable. "Physicist Lee Smolin's estimation that, taking into account all of the fine-tuning, the chance of life being physically possible in a universe with laws/initial conditions of the general form we find in our universe is 1 in 10229, from which he concludes, 'In my opinion, a probability this tiny is not something we can let go unexplained. Luck will certainly not do here; we need some rational explanation of how something this unlikely turned out to be the case'" (Goff, 2019). What could that explanation be?

According to Draper et al (2007), a "surprisingly large" number of philosophers and scientists believe that there is evidence for the existence of other physical universes, a hypothesis known as the Multiverse hypothesis. One opponent of the Multiverse hypothesis, Philip Goff, articulates the hypothesis as follows: "[T]he multiverse hypothesis postulates an enormous, perhaps infinite, number of physical universes other than our own, in which many different values of the parameters are realised. Given a sufficient number of universes realising a sufficient range of the parameters, it is not so improbable that there would be at least one universe with fine-tuned laws" (Goff, 2019).

However, opponents of the MV hypothesis argue that MV proponents are committing what Hacking (1987) called Inverse Gambler's Fallacy (IGF):

The Gambler's Fallacy:

"A gambler, fully accepting the premise of a fair-rolling device, observed a sequence of, say, 35 rolls without a single double six occurring. He reasons that the chance of a double six occurring in 36 rolls is about 2/3, and that it is therefore shrewd to bet that a double six will occur on the next toss. This is the fallacy of someone who reasons that, relative to the evidence of a string of 35 non-double sixes, it is rather likely that a double six will occur at the next roll. But on the assumption of fairness, which I take to include independence of trials, it is not likely. The probability of double six, relative to the evidence, is still 1/36" (Hacking, 1987).

The Inverse Gambler's Fallacy (IGF):

A gambler coming into a room, walking to the fair device, and seeing it roll double six. [The croupier] asks, 'Do you think this is the first roll of the evening? Or have there been many rolls?' The gambler reasons that since double six occurs seldom, there have probably been many rolls (Hacking, 1987).

It is the inference of many rolls from the single improbable roll which is fallacious. Opponents of the MV hypothesis such as Goff (2021) argue, "the inference from the fine-tuning to the multiverse [is] as an instance of fallacious reasoning. Specifically, multiverse theorists commit the inverse gambler's fallacy.

This, however, would represent a moving of the goalposts in relation to the MV hypothesis, since proponents of the FTA argue that we must consider the question in terms of "epistemic probability" (Collins, 2009) or a "Bayesian fine-tuning argument"

(Goff, 2022). When considered in the context of a Bayesian inference, the MV is not inferred from the fine-tuning of the constants, rather the likelihood of the fine-tuned constants is inferred from the MV hypothesis. The question posed by Hacking's croupier then would take the form, "under which hypothesis is the rolling of a double-six more likely, a single roll hypothesis or a many rolls hypothesis?" Hacking (1987) acknowledges, "the more often the pair of dice is rolled, the greater the chance that, in the sequence of rolls, we will obtain at least one double six. In thirty-six rolls, the chance of getting at least one double six is about 2/3. In a thousand rolls, we are almost certain to get at least one double six".

White (2000) summarises the MV proponent's position as follows:

"The more universes there are, the more likely it is that some universe supports life. That is, MV raises the probability that some universe is life-permitting, but not that this universe (α) is life-permitting. But now, the response goes, we know that it is true that some universe is life-permitting, since it follows from the fact that this universe is life-permitting. Therefore, the proposition 'Some universe is life-permitting' confirms MV even if the proposition 'This universe is life-permitting' does not. In other words, our knowledge that some universe is life-permitting seems to give us reason to accept the Multiple Universe hypothesis, even if our knowledge that this universe is life-permitting does not."

Proponents of the MV hypothesis have argued that when this reasoning, together with the anthropic principle (or selection effect) is applied to the MV hypothesis, it is sufficient to account for our own fine tuned universe. Opponents of the MV have, in response, outlined arguments reiterating the IGF which treat "this" Universe as an independent trial in an ensemble.

This Universe Objection

In his paper, Roger White (2000) outlined what Draper et al (2007) call the "This Universe Objection" (TUO):

"The mistake is in supposing that the existence of many other universes makes it more likely that this one—the only one that we have observed— will be life-permitting"(White, 2000)

Expanded upon in Probabilistic Arguments for Multiple Universes (Draper et al, 2007) and Fine Tuning the Multiverse (Metcalfe, 2018), the TUO argument can be stated as follows:

"while the existence of a multiverse might explain why some-universe-or-other permits life, it doesn't explain why this universe (the one we live in) permits life" (Metcalfe, 2018).

As mentioned above, proponents of the MV hypothesis have argued that the anthropic principle (or selection effect) is sufficient for addressing the IGF argument and, although White (2000) offers an explanation of what a selection effect is, we will see below that he fails to apply it correctly to the MV hypothesis:

An observational Selection Effect is a feature of a process which restricts the type of outcomes of an event which are observable. In the case of the Big Bang, had the universe not instantiated T1 then neither we nor anyone else would be around to notice, since the necessary conditions for life would not have been met. So even though big bangs can so easily result in dud universes, no one ever has the misfortune of seeing one. (White, 2000)

Put another way, wherever there are observers like ourselves there must necessarily be a life permitting universe.

White outlines the TUO in objection to the reasoning of the MV proponent on the grounds that "a known proposition, the probability of which *is not* raised by the hypothesis, is being set aside in favour of a weaker proposition, the probability of which *is* raised by the hypothesis. The weaker proposition is then taken as evidence for the hypothesis". (White, 2000)

What has gone wrong, according to White, is that there has been a failure to consider the total evidence available to us. White states that "while the [Multiple Universe hypothesis] may be confirmed by ['Some universe is life-permitting'] alone, it is not confirmed by ['Some universe is life permitting'] in conjunction with the more specific fact that [this universe is life-permitting], which we also know (White, 2000).

White offers the 'Drunk Adam' analogy, which attempts to justify the *requirement for total evidence* and to demonstrate why a weaker piece of evidence cannot be substituted for a stronger piece of evidence. This analogy unfolds as follows:

Suppose I'm wondering why I feel sick today, and someone suggests that perhaps Adam got drunk last night. I object that I have no reason to believe this hypothesis since Adam's drunkenness would not raise the probability of me feeling sick. But, the reply goes, it does raise the probability that someone in the room feels sick, and we know that this is true, since we know that you feel sick. So the fact that someone in the room feels sick is evidence that Adam got drunk. Clearly something is wrong with this reasoning. Perhaps if all I knew by word of mouth, say, was that someone or other was sick, this would provide some evidence that Adam got drunk. But not when I know specifically that I feel sick. This suggests that in the confirming of hypotheses, we cannot, as a general rule, set aside a stronger, specific, piece of evidence in favour of a weaker piece. We must always consider the total evidence available to us (White, 2000). (Emphasis mine).

I don't think anyone would disagree with White's assessment of the Drunk Adam hypothesis. The issue, however, is that it is completely unrepresentative of the fine-tuning issue. While it attempts (successfully or not) to include some form of selection effect, the Drunk Adam hypothesis is unrepresentative of the MV hypothesis, since the MV hypothesis involves many trials of something which gives rise to the selected effect whereas the Drunk Adam hypothesis does not. White's attempt to justify the application of the "general rule" to the case of the MV hypothesis doesn't succeed for this reason. I propose that the Cosmological Slot machine analogy, below, is more representative and clarifies how the selection effect accounts for the moving from the specific evidence to the weaker evidence.

Rigid Designation

The TUO, as outlined by White, requires that we "rigidly designate" a specific universe as being "our universe" or *this* universe, which he refers to with the label "α" :

"[T]he name 'α' is to be understood here as rigidly designating the universe which happens to be ours. Of course, in one sense, a universe can't be ours unless it is life-permitting. But the universe which happens actually to be ours, namely α, might not have been ours, or anyone's. It had a slim chance of containing life at all" (White, 2000). (Underlining mine).

The underlined sentences demonstrate that the TUO does not adequately incorporate the selection effect since the selection effect necessitates that no particular universe be *a priori* "rigidly designated" as "our universe". The Universe we refer to as "ours" is whichever one happens to give rise to life.

This rigid designation of a universe as α or as "this universe" effectively designates, *a priori,* a single iteration of the hypothetical universe generating process and declares it to be "this universe", regardless of whether it turns out to be an LPU or not. This is also the case in the paper by Draper et al (2007), who seek to provide a much-simplified thought experiment. They attempt to outline the Bayesian case using two universes compared to a single universe. In their example, much like White's, one of the pre-existing universes is rigidly designated as α (or "this universe") with the probability of it being LPU given as ½. The matrix of possible scenarios is laid out, and due to the scenario where both universes in the Bi-verse cannot be non-LPU a cancellation leaves the evidence favouring neither the Bi-verse nor the Universe. Metcalfe's (2018) "indexical" argument employs a similar approach, asking us to suppose that "α" is the name of this universe. The argument here is "indexical" because it deals with a particular universe, defined indexically: our universe, i.e., α (Metcalfe, 2018).

The issue lies in the insistence on the "rigid designation" of a random universe as "this universe". In the context of our dice player above, it would be similar to "rigidly designating" the player's 11th roll as "the winning roll" with the possibility of it not actually being the winning roll. In truth, "the winning roll" is whichever roll happens to be a double six. That is essentially how the selection effect operates.

The role of the selection effect

The argument advanced by the proponents of the FTA essentially just repeats the already known from fact: in statistically independent trials, the probability of an individual trial does not change, regardless of the number of trials carried out. As White (2000) states, "events which give rise to universes are not causally related in such a way that the outcome of one renders the outcome of another more or less probable. They are like independent rolls of a dice". This fact relating to the statistical independence of individual trials is not disputed. Similarly, proponents of the FTA do not dispute the claim that the MV hypothesis effectively makes at least a single LPU a certainty. The issue then, is the role played by the selection effect and whether it makes the existence of *this universe* more likely. As White says, "in order for the Multiple Universe

hypothesis to render our existence more probable, there must be some mechanism . . . linking the multiplicity of universes with our existence". But, says White, "there is no such mechanism. So the existence of numerous universes does not seem to make it any more likely that we should be around to see one" (White, 2000). This claim is incorrect, however, since the selection effect is this very mechanism. The selection effect is precisely why we cannot insist on "rigid designation" of a random iteration of the universe generating process as "this universe", because any of the universes produced by this process could have been the one which is the LPU, the inhabitants of which would refer to their universe as "this universe".

To further clarify the issue, let's consider the Cosmological Slot machine analogy.

The Cosmological Slot Machine

I'm sure most of us will be familiar with the classic "One Armed Bandit" slot machines so emblematic of Las Vegas casinos; if not from personal experience then from seeing them on TV. It is a machine where a coin is inserted and a mechanical arm is pulled at the side of the machine, which sets a set of reels turning on the face of the machine. If the reels stop in a winning combination, the player wins money. There is a probability associated with the winning combination. Let's say that in our Cosmological Slot Machine there are five reels with either the letters of the alphabet inscribed on them, or any combination of alphanumeric and/or special characters we prefer. Let's say the winning combination is when the reels spell out the word G-E-N-I-E (in that order) and when that happens, although not guaranteed, a genie can appear out of the machine to contemplate its own existence – we don't need to assume that only one slot machine can produce the winning sequence or that every slot machine with the winning sequence will produce a genie.

Let us stick with the aforementioned probability value of 1 in 10229. Let's imagine that there is a single slot machine which we rigidly designate as α. Obviously, the probability of an LPU here (getting the winning combination) is "vanishingly small".

Now, let us consider a scenario where we have 102,290 (or more) slot machines. The arm is pulled on all of them, the reels spin and the winning combination does not appear on α. Instead the word G-E-N-I-E appears on several other machines including the machine rigidly designated as γ. A genie magically appears from γ. How do we think this genie will refer to the machine rigidly designated as α? Will they refer to it as "*this* slot machine"? Of course they won't, the indexical term "this" will be reserved for

their own slot machine; the one rigidly designated as γ. Note, the probability of γ being life permitting was still 1 in 10229, however, the selection effect meant that it didn't matter which rigidly designated slot machine displayed the winning combination, it simply meant that whichever one displays the combination becomes "this universe".

Much like how the Martingale betting system nullifies the gambler's fallacy, by allowing repeated bets until a winning bet occurs, the MV hypothesis allows for repeated universes until an LPU is created. When life emerges in such an LPU, those inhabitants refer to their own universe as "this Universe", just as we do with ours.

Cyclical

The Slot machine example above represents a multiverse model of parallel universes (PMV). There is, however, another alternative where universes are sequential, or rather, cyclical (CMV). While the idea of cyclical and indeed parallel universes is "entirely natural in Indian traditions" (Joshi, 2017), the Conformal Cyclic Cosmological (CCC) model developed by Roger Penrose attempts to put it on a more rigorous scientific footing.

We can consider the case for a cyclical cosmology either by considering our cosmological slot machine on its own or in the context of the Bi-verse example provided by Draper et al (2007) to demonstrate how a cyclical model is immune from that particular argument. So, lets imagine two slot machines one rigidly designated α. The probability of α displaying the winning combination and our genie appearing are again, 1 in 10229. Now, we can imagine the machine running but the winning combination not being displayed. In a cyclical cosmology, the machine simply goes again, and again, and again, until eventually the winning combination is displayed and our genie appears to contemplate its own existence. Of course, the machine doesn't stop there, it goes again, and again, and again, and eventually the winning combination will appear again. This is all with our slot machine rigidly designated α. It is this application of the selection effect which negates the TUO.

Conclusion

Proponents of the FTA have attempted to object to the Multiverse hypothesis claiming that it commits the Inverse Gamblers Fallacy and cannot account for the fact that *this* Universe is fine-tuned. This objection, however, tends to be grounded in a strict inference directly from the evidence, while FTA proponents argue that it should be considered in the context of a Bayesian inference. Under a Bayesian inference, with the likelihood of the evidence inferred from the hypothesis, the MV hypothesis makes a single fine-tuned universe very probable. The TUO argues that while it makes *a* single fine-tuned universe very probable, the MV hypothesis doesn't make *this* universe more probable. However, the TUO fails to accurately account for the role of the selection effect, which serves as the mechanism that links the multiplicity of universes with our existence, thereby bridging the gap from a weaker piece of evidence to a stronger piece and satisfying White's (2000) requirement for total evidence.

Just as the Martingale betting system nullifies the improbability of associated with individual rolls of a dice, by allowing repeated rolls until a winning combination is rolled; so too does the MV hypothesis nullify the improbability that individual universes will be fine tuned, by allowing for the repeated creation of universes until an LPU is produced. Just as the "winning roll" for the gambler is not rigidly designated from the outset, it is rather that roll which comprises the winning combination, so the universe referred to as "this Universe" cannot be rigidly designated. The selection effect means whichever universe produces the "winning combination" will be referred to, by its inhabitants, as "this Universe".

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