

God, Fine-Tuning, and the Problem of Old Evidence

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ABSTRACT

The fundamental constants that are involved in the laws of physics which describe our universe are finely tuned for life, in the sense that if some of the constants had slightly different values life could not exist. Some people hold that this provides evidence for the existence of God. I will present a probabilistic version of this fine-tuning argument which is stronger than all other versions in the literature. Nevertheless, I will show that one can have reasonable opinions such that the fine-tuning argument doesn't lead to an increase in one's probability for the existence of God.

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1 The fine-tuning argument

This article is about the fine-tuning argument for the existence of God, which runs roughly as follows:

Premise 1: The fundamental constants that are involved in the laws of physics which describe our universe (such as the masses of the fundamental particles and the strength ratios between the fundamental forces) are finely tuned for life, in the sense that if some of the constants had values outside some narrow range then life could not exist. (I will call this 'the fine-tuning evidence'.)

Lemma: It would be very unlikely for the universe to have life-permitting fundamental constants by chance. (This follows from Premise 1.)

Premise 2: If God created the universe, we would expect it to be life-permitting.

Premise 3: The universe is life-permitting.

Conclusion: Thus, given the fine-tuning evidence, the fact that the universe is life-permitting provides evidence for the existence of God. (This follows from the Lemma and Premises 2 and 3.)

This article has two main theses. I will argue that the specific version of the fine-tuning argument I will present below is stronger than all other versions in the literature. I will show that the fine-tuning argument is best presented using a subjectivist interpretation of probability; objections to the fine-tuning argument which rely on a frequency-based objective or logical interpretation of probability are flawed. Nevertheless, I am not a proponent of the fine-tuning argument. My second thesis is that one can have reasonable opinions such that the fine-tuning argument doesn't lead to an increase in one's probability for the existence of God. This doesn't count as a full-scale refutation of the fine-tuning argument, since I admit that one can have reasonable opinions such that the argument *does* lead to an increase in one's probability for the existence of God. But I believe that no stronger reply to the fine-tuning argument is successful.

The fine-tuning argument is generally not taken, even by its proponents, to provide a definitive proof of the existence of God. (In contrast, proponents of the ontological and cosmological arguments generally present their arguments as purely deductive.) As a result, the fine-tuning argument is well-suited to be represented in a probabilistic framework. So let's look at the argument as formulated using probability theory.

The basic version of the probabilistic fine-tuning argument I will be discussing in this article is as follows. (The fine-tuning argument is presented in this sort of way by, for example, Swinburne ([1990], p. 155; [2004], p. 189), Le Poidevin ([1996], pp. 47–8), Collins ([1999], p. 57), Holder ([2002], pp. 298–9), and Manson ([2003], p. 7). There are other versions of the fine-tuning argument in the literature, but I will be focusing on this one.)

Let L be the proposition that the universe is life-permitting, and let G be the proposition that God exists.¹ According to proponents of the fine-tuning argument, L provides epistemic support for G . A standard way of understanding the claim that L provides epistemic support for G is to say that learning that L increases one's probability for G : $P(G|L) > P(G)$. Proponents

¹ If one prefers, the proposition G can be taken to include the possibility that some supernatural designer exists, without that designer having all the attributes we would attribute to God. I mention this possibility because some proponents of intelligent design are at pains to maintain that they are not arguing for the existence of God, but just for the existence of a designer. In the case of the fine-tuning argument, that designer would be a designer of the universe, so would presumably have to at least be supernatural.

of the fine-tuning argument argue that this inequality holds, since $P(L|G) > P(L)$, and by Bayes' Theorem:

$$\frac{P(G|L)}{P(G)} = \frac{P(L|G)}{P(L)}.$$

Why is it that case that $P(L|G) > P(L)$? That claim is equivalent to:

$$P(L|G) > P(L|G)P(G) + P(L|\sim G)P(\sim G).$$

Proponents of the fine-tuning argument maintain that $P(L|G) > P(L|\sim G)$, and it follows that $P(L|G) > P(L)$ [because $P(L)$ is a weighted average of $P(L|G)$ and a quantity less than $P(L|G)$].

Why is it the case that $P(L|G) > P(L|\sim G)$; why is it more probable that the universe is life-permitting under the supposition that God exists than under the supposition that God doesn't? Here is where proponents of the fine-tuning argument appeal to the evidence of fine-tuning. They argue that, for various fundamental constants, such as the constant representing the strength of the gravitational force, and the constant representing the proton/neutron mass difference, these constants have to have a value in a relatively narrow range in order for life to exist. (For a nice up-to-date discussion of these fine-tuning claims, see Collins ([2003]).) Proponents of the fine-tuning argument then argue that, if the fundamental constants of the universe were selected naturalistically (via an objectively chancy process, for example), one would expect the constants to be such that the universe is not life-permitting. But if the constants were selected supernaturalistically, one would expect the universe to be life-permitting (because God would pick the constants so as to guarantee the existence of life). It follows that $P(L|G) > P(L|\sim G)$, and thus $P(G|L) > P(G)$, as desired.

2 Objective versus subjective probability

In the previous section, I presented the fine-tuning argument as utilizing a probability function P , but I did not specify what concept of probability this function was meant to represent. I will now consider three interpretations of probability, and show that the fine-tuning argument is different depending on which interpretation of probability one chooses. I will look at the frequency-based objective interpretation, the logical interpretation, and the subjectivist interpretation, and I will argue that the fine-tuning argument is most promising on the subjectivist interpretation.

First, consider a frequency-based objective interpretation of probability, where the probability for an event is (at least in part) determined by the actual frequency with which the event has occurred in past trials. For example, on a frequency-based objective interpretation, the probability of a fair coin

landing heads is about 1/2 because out of all coin-flips with these sort of coins in the past, about half of those coin flips landed heads.

Now, what happens when the fine-tuning argument is understood as utilizing a frequency-based objective interpretation of probability? Well, the fine-tuning argument runs into trouble. This can be seen in one of Elliot Sober's ([2003], p. 49) criticisms of the fine-tuning argument. Sober maintains that 'the argument from fine-tuning can't be defended as a claim about probabilities'. But his criticism relies on a frequency-based objective interpretation of probability, and he gives no argument to defend that choice of interpretation.

Sober's criticism is short and straightforward. He says that 'we have neither theory nor data on which to ground' the claim that $P(G|L) > P(G)$. He concludes that the fine-tuning argument (when construed as an argument involving probabilities) 'makes claims about probabilities that we have no reason to accept' ([2003], pp. 48–9). To justify his claim that we have neither theory nor data to establish the probability claims, he contrasts the fine-tuning argument with the firing squad example (Leslie [1989], pp. 13–5), where a prisoner finds himself alive after the marksmen shoot. Sober maintains that in the firing squad example, when the prisoner finds himself alive, the prisoner should increase his probability for the hypothesis that the marksmen intended to miss. The reason this is the case, Sober says, 'we have frequency data and our general knowledge of human behavior on which to ground' the probability shift. The firing-squad example is meant by Leslie to be analogous to the fine-tuning argument: just as the prisoner's being alive is more likely under the design hypothesis than under the chance hypothesis, so the universe being life-permitting is ostensibly more likely under the design hypothesis than under the chance hypothesis. But Sober rejects this analogy, because he maintains that we have no such frequency data or general knowledge in the case of the fine-tuning argument.

Sober concludes the section of his article where he discusses these issues by saying that not only do we have no reason to accept the fine-tuning argument's claims about probability, 'we cannot even *understand* them as objective claims about nature' ([2003], p. 49). I maintain that the fine-tuning argument is unfairly weakened if it is saddled with the requirement that its probability claims must be objective claims about nature. Sober is clearly right that we have no frequency data on the proportion of life-permitting universes, and perhaps he is also right that we have no theory which can enable us to make objective claims about the probability of a universe being life-permitting. But these considerations are not sufficient to set aside the probabilistic fine-tuning argument. There is no requirement in the fine-tuning argument that its claims about probability be understood as objective claims about nature.

On the subjectivist interpretation of probability, one's probability for a proposition represents one's personal degree of belief that that proposition is true. On the subjectivist interpretation, the fine-tuning argument would be successful for an agent, as long as that agent's subjective probabilities are such that $P(G|L) > P(G)$. (I will discuss in detail how this reasoning is meant to work in Section 4 below.) Thus, the fine-tuning argument utilizing the subjectivist interpretation of probability is more promising than the fine-tuning argument utilizing the frequency-based objective interpretation, because on the subjectivist interpretation there is at least hope that one can have probability assignments such that the argument is successful.²

I will now show that the fine-tuning argument fares better on the subjectivist interpretation of probability than it does on the logical interpretation of probability. What I mean by 'the logical interpretation of probability' is that probabilities are determined through a priori reasoning, such as reasoning in accordance with the Principle of Indifference. Timothy McGrew, Lydia McGrew, and Eric Vestrup ([2001]) (henceforth MMV) treat the fine-tuning argument as utilizing the logical interpretation, and present an emphatic critique of the fine-tuning argument interpreted in this way.³ They take the fine-tuning argument to be utilizing the Principle of Indifference, and thus attribute to proponents of the fine-tuning argument the view that it is unreasonable to assume that one sort of universe is more probable a priori than any other sort. They then conclude that the fine-tuning argument can't be coherently formulated, since the space of possible sets of values for the fundamental constants is unbounded, and hence non-normalizable. They say that 'Probabilities make sense only if the sum of the logically possible disjoint alternatives adds up to one' (McGrew *et al.* [2001], p. 203), but that's not possible for a non-normalizable space of possibilities where each possibility is treated the same. Either each possibility will be assigned probability zero, in which case the total will be zero, or each possibility will be assigned some fixed positive probability, in which case the total will be infinite. They

² Robin Le Poidevin ([1996], pp. 49–57) also interprets the fine-tuning argument as utilizing something like a frequency-based objective interpretation of probability. Le Poidevin ([1996], p. 57) considers only the frequency and propensity theories of probability, and argues that on either theory 'it makes no sense to talk of the probability of a life-sustaining universe in the absence of God'. He rejects the fine-tuning argument on that basis. I maintain that Le Poidevin is unfairly saddling the fine-tuning argument with a frequency or propensity theory of probability; the fine-tuning argument is more promising on a subjectivist interpretation.

³ A similar interpretation and critique is given by Colyvan *et al.* ([2005]). It's not crucial to MMV's argument that the logical interpretation is being used; that's just one way to motivate the Principle of Indifference. What MMV and Colyvan, Garfield, and Priest are arguing is that the right way to understand the fine-tuning argument is as using the Principle of Indifference to generate probability assignments, and when the fine-tuning argument is understood in that way, the argument is unsuccessful.

take this reply to succeed in ‘demolishing’ (McGrew *et al.* [2001], p. 207) the fine-tuning argument.

In my opinion (which I will not defend here), MMV are making too much of a technical issue in probability theory. Indeed, work has been done on resolving this technical issue. Peter Vallentyne ([2000]), for example, has come up with a sophisticated yet natural way of making comparative probability judgments, even when the various possibilities being compared all have probability zero. I won’t go into Vallentyne’s solution here; I will just note as a potential problem that what motivates Vallentyne’s work is simply the intuition that probability judgments should make sense even when the probabilities for the various disjoint possibilities don’t sum to one (that is, when countable additivity fails). It follows that it would be open to MMV to reject Vallentyne’s solution by rejecting that intuition.

The response I will now give to MMV’s argument is that the fine-tuning argument need not be formulated using the Principle of Indifference. This is so in two senses: there is no compelling reason to endorse the Principle of Indifference, and the success of the fine-tuning argument does not hinge on the truth of the Principle of Indifference. Both these points can be seen once one moves to the subjectivist interpretation of probability. (MMV give reasons not to utilize the subjectivist interpretation; I will critique their reasons below.)

The fine-tuning argument on the subjectivist interpretation has various benefits over the fine-tuning argument on the logical interpretation. One benefit is that on the subjectivist interpretation, one need not rely on the Principle of Indifference. An agent *could* assign her subjective probabilities in accordance with the Principle of Indifference, but the important point is that the agent need not. It is open for an agent to assign zero probability to some possible values of constants, and non-zero probability to other possible values. It follows that the probabilities assigned to the various disjoint possibilities can sum to one—something that could not happen on MMV’s formulation of the fine-tuning argument.

Another benefit is that on the subjectivist interpretation, one need not even bother to assign probabilities to the various possible values of constants; one can just assign probabilities to propositions like *L*, that the universe is life-permitting. There is no need to generate one’s probabilities in any sort of foundational way, by, for example, assigning probabilities to each element in the space of possible sets of values of the fundamental constants, as long as the probability assignments one does make are probabilistically coherent, which is enough to satisfy the constraints of the subjectivist interpretation. The reason it matters that on the subjectivist interpretation, one need not assign probabilities to the various possible sets of values of the fundamental constants, is that one then won’t run into the problems that arise if one were

to use the Principle of Indifference to assign probabilities to the various possible values. Moreover, such assignments to the various possible sets of values of the fundamental constants aren't needed to generate the fine-tuning argument. This can be seen by looking at the presentation of the argument in the previous section—the argument never depends on probability assignments to individual possibilities for the values of constants; the argument just depends on probability assignments to propositions like L , that the universe is life-permitting.

Once one moves to the subjectivist interpretation, one allows for an agent to have her personal probability function be such that $P(G|L) > P(G)$, but one also allows for an agent to have her personal probability function be such that $P(G|L) = P(G)$. For the strongest defense of the fine-tuning argument, one would have to argue that only probability functions which are such that $P(G|L) > P(G)$ are reasonable ones; all other probability functions are unreasonable. For a weaker defense, one could simply argue that for a wide class of agents, it's actually the case that their probability functions are such that $P(G|L) > P(G)$. I will now discuss MMV's criticism of the subjectivist interpretation, which takes issue with these two lines of defense.

MMV are aware that their critique of the fine-tuning argument could be criticized for relying on a non-subjective account of probability, and so they go on the offensive against the subjectivist interpretation. They write:

in our opinion it is profoundly unsatisfying to stipulate that we can just 'tell' which [probability] functions are reasonable and which are not. Reasonable people have conflicting intuitions here If, at a critical point, the [fine-tuning] argument turns on a subjectively variable sense of which assessments of probabilities are reasonable, a sense that cannot be adjudicated in terms of any more fundamental criteria, then the [fine-tuning argument] is effectively forceless. (McGrew *et al.* [2001], p. 206)

There is something rhetorically strange about this criticism. MMV, by their lights, have just shown that the fine-tuning argument on the logical interpretation is demolished. One is then led to ask whether the fine-tuning argument would fare any better on a different interpretation of probability. MMV proceed to reject the subjectivist interpretation, because the fine-tuning argument would be weak on that interpretation. But then why not reject the logical interpretation too? If those are the only two interpretations on the table, and one is being charitable to the fine-tuning argument, then one should focus on how the fine-tuning argument fares on the interpretation that is most promising. On the subjectivist interpretation, as MMV implicitly admit, the argument is not demolished; the argument would go through for

those agents who happen to have subjective probability functions such that $P(G|L) > P(G)$.

There is a more substantive problem with MMV's criticism too. MMV suggest that we should not expect agreement on which subjective probability functions are reasonable and which aren't. But in fact, for many cases there is widespread agreement about such matters. For example, any reasonable person would reject a probability function which held that the sky being blue provides evidence that the moon is made of green cheese. It would be worth examining whether there is similar widespread agreement that only probability functions which are such that $P(G|L) > P(G)$ are reasonable. This is what I will try to do in Section 5 below.

Nevertheless, there is something correct about MMV's criticism. It is the case that, on the subjectivist interpretation, there is no way to ensure that all reasonable, rational agents have the same probability function. But this is just the way the world is; different people have different opinions about things, even when the people are all being reasonable and rational. The point of the subjectivist interpretation is to probabilistically represent rational people's actual opinions; the point is not to see what probabilities are generated when one applies ostensibly a priori principles like the Principle of Indifference.

To sum up: I have argued that the fine-tuning argument utilizing the subjectivist interpretation of probability is more promising than the fine-tuning argument utilizing a frequency-based objective or logical interpretation of probability. My arguments have been parochial ones, in the sense that they have mostly focused on the implications of the various interpretations for the fine-tuning argument. A different way to debate the merits of the various interpretations for the fine-tuning argument would be to debate the merits of the various interpretations themselves. For example, I believe that the frequency-based objective interpretation should be rejected because we often assign probabilities in the absence of frequency data, and the logical interpretation should be rejected because at least sometimes there are multiple rational yet conflicting ways to apply ostensibly a priori principles like the Principle of Indifference. But these issues are part of a huge debate in the literature, and to engage in that debate is beyond the scope of this article. This section is simply designed to show that the fine-tuning argument is most promising on the subjectivist interpretation of probability.

Now, I admit that my claim that the fine-tuning argument doesn't fare well on non-subjectivist interpretations of probability hasn't been conclusively defended in this section. While I have argued for that claim, I admit that my arguments aren't definitive. If you are in agreement with my arguments, then the natural move is to evaluate the fine-tuning argument utilizing the subjectivist interpretation of probability. But even if you are not in agreement

with my arguments, it's still worth examining how the fine-tuning argument fares on the subjectivist interpretation, and that's what I'll be doing for the rest of this article.

3 Observational selection effects

Given that one takes the subjective probability approach to the fine-tuning argument, there is a simple but prima facie powerful objection to the argument which must be considered. The objection is that we know that we exist, and hence we already fully believe that the universe is life-permitting: $P(L) = 1$. It automatically follows that $P(L | G) = P(L | \sim G)$, and hence $P(G | L) = P(G)$.

This is the sort of objection that Sober ([2003], p. 44) raises against the fine-tuning argument. In Section 1, I presented the fine-tuning argument as depending on the following inequality:

$$P(L | G) > P(L | \sim G) \quad (1)$$

Sober agrees that the argument boils down to this inequality, but in place of ' G ' Sober has 'Design', in place of ' $\sim G$ ' Sober has 'Chance', and in place of ' L ' Sober has 'constants are right' (in other words, the constants are what they would need to be for the universe to be life-permitting). I take it that I'm not changing the meaning of his discussion by doing these substitutions.

Sober maintains that there's a problem with (1). Specifically, Sober says that we need to take the following claim into account:

We exist, and if we exist the constants must be right.

Sober says that since we need to take that claim into account, 'instead of [(1)], we should have said':

$$P(L | G \ \& \ \text{we exist}) = P(L | \sim G \ \& \ \text{we exist}) = 1 \quad (2)$$

Sober says that we have to evaluate the fine-tuning argument using (2), not (1), because of an observational selection effect: if we didn't exist, we wouldn't be able to make any observations. Sober ([2003], p. 44) then points out that, given that we exist, 'the constants must be right, regardless of whether the Universe was produced by intelligent design or by chance'. Sober concludes from this that the fact that the universe is life-permitting and hence that the constants are right does not favor Design over Chance; in other words, according to Sober, L does not provide evidence for G , and hence the fine-tuning argument fails.

I believe that an appeal to an observational selection effect is not a good reply to the fine-tuning argument. Even though L has to be the case in order for us to make observations at all, it doesn't follow that L can't provide evidence for some proposition (like G). In this section, I will give an example to show that there are circumstances where we clearly take the fact that the

universe is life-permitting to count as evidence for a proposition. In the next section, I will lay out a general theoretical framework that allows for this sort of evidential relation.

Suppose that you find yourself in the presence of a closed box, and in communication with God. God tells you that inside the box is a ball that is either black or white. Since you have no further information about the color of the ball, you decide to assign subjective probability 0.5 to the proposition that the ball is white. Suppose that God then tells you that, to decide whether or not to create a life-permitting universe, he used a random number generator to generate an integer between 1 and 20: if a number between 1 and 9 was generated, God created a non-life-permitting universe and put a black ball in the box, while if the number 10 was generated, God created a non-life-permitting universe and put a white ball in the box. If a number between 11 and 19 was generated, God created a life-permitting universe and put a white ball in the box, while if the number 20 was generated, God created a life-permitting universe and put a black ball in the box.

Based on this new understanding of the relationship between the existence of a life-permitting universe and the color of the ball, it seems clear that one should revise one's probability for the hypothesis that the ball is white, from 0.5 to 0.9. (Since the universe is life-permitting, we can infer that the generated random number was between 11 and 20; 9 of those 10 numbers correspond to a white ball in the box.) Hence, this is a scenario where the existence of a life-permitting universe counts as evidence for the proposition that the ball is white. This is so even though we already fully believe that the universe is life-permitting. It follows that there is something wrong with the suggestion that an observational selection effect prevents the existence of a life-permitting universe from having evidential significance for us.

Let me consider one objection to this line of reasoning, before I move on. One might maintain that I'm mistaken in taking the existence of a life-permitting universe to provide evidence that the ball is white; instead it's what God tells us about the random number generator that provides evidence that the ball is white. To this I reply that it's both facts together that provide evidence that the ball is white. The existence of a life-permitting universe doesn't by itself provide the evidence; before we heard from God we assigned probability 0.5 to the hypothesis that the ball is white. But what God tells us doesn't by itself provide the evidence either. If we knew what God told us, but we didn't know that the universe is life-permitting, we would still assign probability 0.5 to the hypothesis that the ball is white.

The fine-tuning argument works the same way. Knowing that the values of the fundamental constants are life-permitting doesn't by itself provide evidence that God exists—one also has to think it likely that God would create a life-permitting universe. It's these two facts together that are meant to

provide evidence for the existence of God. I conclude that my example of God and the random number generator really is analogous to the fine-tuning argument. Since it would be a mistake to appeal to an observational selection effect as a reason not to change one's probabilities in the God/random number generator example, it would also be a mistake to appeal to an observational selection effect as a reason not to change one's probabilities in the case of the fine-tuning argument.

4 The problem of old evidence

Let's go back to the objection as presented at the beginning of the previous section: we already believe that the universe is life-permitting, and hence $P(L) = 1$, and hence $P(G|L) = P(G)$.

This objection is not adequate as a reply to the fine-tuning argument, because it proves too much. There are many cases where we have some evidence E such that $P(E) = 1$, and yet we think that E provides epistemic support for some hypothesis H . Perhaps the most famous example is E being the (true) proposition that the precession of the perihelion of Mercury is 5600 s of arc per century, and H being general relativity. When general relativity was proposed, people already knew what the amount of the precession of the perihelion of Mercury was, and yet the precession was taken to provide epistemic support for general relativity. This is one instance of the problem of old evidence.

Note that problem of old evidence wouldn't arise for an ideal Bayesian agent, because by definition such agents are logically omniscient. An ideal agent would know about the proposition H and would assign some probability to H at the beginning of her reasoning process (such as when she is born). As long as E is evidence in the sense that it wasn't available to her at the beginning of her reasoning process, then there will be some time when her prior probability function is updated by learning E . When she learns that E she will immediately see the evidential connection between E and H , so her probability for H would be adjusted accordingly. Because the problem of old evidence doesn't arise for ideal Bayesian agents, it is allowable for a solution to the problem to deviate from the strict Bayesian rules. Indeed, the solution I will utilize below does this.

There is no agreed-upon solution to the problem of old evidence, but one standard type of solution is as follows. (See Glymour ([1980], pp. 87–91), Howson ([1984], [1985], [1991]), Jeffrey ([1995]), and Barnes ([1999]) for some discussions of this solution.) Let P^- be one's prior probability function, and let P^+ be one's posterior probability function, once one has taken into account that there is a potential evidential connection between E and H . According to this solution to the problem of old evidence, once one learns

about the potential connection, one should suppose that one does not fully believe that E , and revise all one's probability assignments accordingly, to generate an ur-probability function P^* . One should then set $P^+(H) = P^*(H|E)$. There are many cases where $P^-(H) = P^*(H)$, since in pretending that one does not fully believe that E , that would generally not influence one's probability for H . In such cases, as long as $P^*(H|E) > P^*(H)$, then $P^+(H) > P^-(H)$, and E counts as evidence for H .

One of the drawbacks of the ur-probability solution is that it is not always clear what values the ur-probabilities should take, especially when one has to make extreme modifications to one's opinion, by, for example, supposing that one does not fully believe that one exists. (For example, one much-discussed issue is whether one should suppose that one never fully believed that E was true, or whether one should suppose that one forgot that E was true.) Nevertheless, we need to have some way of accounting for how propositions like L can count as evidence, and the ur-probability solution is the best approach available. As far as I know, though, there is no instance in the literature of a proponent of the fine-tuning argument citing the problem of old evidence in their discussion of the argument, let alone utilizing the ur-probability solution in formulating the argument.⁴ As a result, proponents' presentations of the fine-tuning argument are less strong than they could be.

Here is how the fine-tuning argument goes, utilizing the ur-probability solution. One starts with an initial probability for the existence of God, $P^-(G)$, and one wants to see whether the fine-tuning evidence is such that the fact that our universe is life-permitting provides evidence for G . In short, one wants to see whether $P^+(G) > P^-(G)$.

One can start by generating an ur-probability function under the supposition that one does not fully believe that L . One can assume that $P^-(G) = P^*(G)$, as is standard in cases involving old evidence. (I will come back to this assumption later, however.) To establish a value for $P^+(G)$, one can use Bayes' Rule: $P^+(G) = P^*(G|L) = P^*(L|G) P^*(G)/P^*(L)$. To establish a value for $P^*(L)$, it helps to note that $P^*(L) = P^*(L|G) P^*(G) + P^*(L|\sim G) P^*(\sim G)$. So the crucial question becomes: what are the values for $P^*(L|G)$ and $P^*(L|\sim G)$?

In fact, we don't need to come up with precise values for those quantities. As long as $P^*(L|G) > P^*(L|\sim G)$, we have the desired result that $P^+(G) > P^-(G)$. This follows because $P^*(L)$ is a weighted average of $P^*(L|G)$ and $P^*(L|\sim G)$, so if $P^*(L|G) > P^*(L|\sim G)$, then $P^*(L|G) > P^*(L)$.

⁴ There is an unpublished article by Robin Collins ([unpublished]), however, where he does utilize the problem of old evidence approach in the course of defending the fine-tuning argument. Collins and I developed our ideas independently.

If $P^*(L|G) > P^*(L)$, then $P^*(G|L) > P^*(G)$ (from Bayes' Rule). It would then follow that $P^+(G) = P^*(G|L) > P^*(G) = P^-(G)$, as desired.

At this point, all the proponents of the fine-tuning argument need to show is that $P^*(L|G)$ is indeed greater than $P^*(L|\sim G)$. Here is where they can appeal to the fine-tuning evidence. $P^*(L|\sim G)$ is low, because the range of life-permitting fundamental constants is small compared to the range of all possible fundamental constants. $P^*(L|G)$, by contrast, is high, because one would expect God to create a life-permitting universe. It follows that $P^+(G) > P^-(G)$; the fine-tuning evidence does lead to an increase in one's probability for the existence of God.

This argument for theism is not easily refuted. I think that philosophers haven't always appreciated how strong the fine-tuning argument is, because it hasn't been presented in the way that I have presented it above. In lieu of the appeal to the ur-probability solution to the problem of old evidence, the fine-tuning argument has been presented in a way such that it's generally not clear how probabilities involving L are generated; specifically, it's generally not clear how probabilities of the form $P(L|X)$ can take any value other than one. (See, for example, the list of references cited in Section 1.) What I have shown is that, by appealing to the ur-probability solution to the problem of old evidence, one can present a rigorous version of the fine-tuning argument.

5 Against the fine-tuning argument

Since the above version of the fine-tuning argument relies on a subjectivist interpretation of probability, there's a sense in which the argument is easy to refute. One simply needs to come up with a prior and ur-probability function such that $P^+(G) = P^-(G)$. For an agent with those probability functions, the fine-tuning argument will not be successful. The important question though is whether such probability functions are reasonable ones to have. Do reasonable people who are opposed to the fine-tuning argument actually have those probability functions, or could they reasonably adopt them?

Consider the option of adopting an ur-probability function such that $P^*(L|G) = P^*(L|\sim G)$. One way to get this equality would be to hold that $P^*(L|\sim G)$ is high, while going along with the claim of the proponents of the fine-tuning argument that $P^*(L|G)$ is high. One natural way to hold that $P^*(L|\sim G)$ is high involves rejecting the fine-tuning evidence. In other words, one would hold that the fundamental constants could take a wide range of values and still be life-permitting. If one sincerely believed that the fine-tuning evidence was faulty, then it might be legitimate to set $P^*(L|\sim G)$ to be high. Physicist Steven Weinberg could be one of these people: he has

said that he is ‘not impressed with these supposed instances of fine-tuning’ ([1999], p. 46). But for those who are moved by the fine-tuning evidence, this is not a live option.

A different way to get the result that $P^*(L|G) = P^*(L|\sim G)$ would be to hold that $P^*(L|G)$ is low, while going along with the claim of the proponents of the fine-tuning argument that $P^*(L|\sim G)$ is low. One could hold that—in the absence of belief that the universe is life-permitting—one sees little reason for God to create a life-permitting universe. This is how Jan Narveson ([2003], pp. 97–9), for example, might respond to the fine-tuning argument. Narveson suggests that, if God were to exist, the ways of God would be so mysterious that we couldn’t make any reasonable predictions about what God would or wouldn’t do. Thus, it would be open to Narveson to say that the ur-probability of a life-permitting universe is the same regardless of whether God exists.

Even though there’s a sense in which the fine-tuning argument is easy to refute (in, for example, the above-described ways), there’s a sense in which it’s not. To be unmoved by the fine-tuning argument in the ways described above, one actually has to believe that the fine-tuning evidence is faulty, or one actually has to believe that God would not be expected to create a life-permitting universe. Since (in my opinion, at least) belief is not a matter of the will, as long as one does not hold these beliefs, one cannot refute the fine-tuning argument in these ways. In fact, in my opinion most people would reject those beliefs—most people would find the fine-tuning evidence at least somewhat plausible, and most people would deem it probable that God would create a life-permitting universe.

The response I will now give to the fine-tuning argument is stronger than those considered above, in that it does not involve rejecting premises of the argument that most people find plausible. The premise of the argument I will question is one that hasn’t been questioned before, but that’s because the premise isn’t salient unless one formulates the argument utilizing ur-probabilities. I maintain that for most everyone it is unreasonable to hold that $P^-(G) = P^*(G)$, instead $P^*(G)$ should be much lower than $P^-(G)$. The reason this is the case is that for almost everyone, beliefs that entail that the universe is life-permitting are part of the evidence people have taken into account in forming their prior probability for the existence of God, $P^-(G)$. (Their probability is ‘prior’ in the sense that they have not yet taken into account the fine-tuning evidence.) For example, Christians believe in God in part because they believe Biblical accounts about Jesus, but the existence of Jesus entails that the universe is life-permitting. In formulating an ur-probability for the existence of God, one cannot take into account Biblical accounts about Jesus. More generally, one cannot take into account the existence of complex features that Paley appeals to, like the human eye, one

cannot take into account the existence of consciousness, and so on. One's unprobability for the existence of God would have to be founded on the plausibility of a priori arguments for the existence of God, like the ontological argument, and the plausibility of arguments which appeal to general features of the universe that don't entail the universe is life-permitting, like the cosmological argument. The only types of people for whom it wouldn't be the case that $P^-(G) > P^*(G)$ are those whose sole reasons for believing in God are arguments like the ontological argument and the cosmological argument.

Now, recall that $P^+(G) = P^*(G|L)$. In the previous section, where it was assumed that $P^-(G) = P^*(G)$, to establish that $P^+(G) > P^-(G)$, all we had to do was establish that $P^*(G|L) > P^*(G)$. Now, we see that matters are more complicated: even if $P^*(G|L) > P^*(G)$, it still could be the case that $P^*(G|L) = P^-(G)$, and hence $P^+(G) = P^-(G)$. What one has to establish is whether the fine-tuning evidence gives one more of a reason to believe in the existence of God, besides all the evidence one had from before which was based on the universe being life-permitting.

It turns out that this depends on the details of *how* one supposes that one doesn't know that the universe is life-permitting. (Here and below, I will assume that when one doesn't know that P , one knows that one doesn't know that P , and hence one doesn't fully believe that P .) I will describe various scenarios for supposing that one doesn't know that the universe is life-permitting, the first of which is favorable to proponents of the fine-tuning argument, the others of which are not. I will then argue that there is no conclusive reason to favor one scenario over the others.

First, one can imagine that one does not know that the universe is life-permitting by imagining that one knows the form of the fundamental physical laws of the universe, but one does not know the values of the constants that are involved in those laws. Before taking into account the fine-tuning evidence, one might have thought that a wide range of values for the fundamental constants would allow for a life-permitting universe, but the fine-tuning evidence shows that that is not the case. It follows that $P^*(G|L) > P^-(G)$, and the fine-tuning argument is successful.

Alternatively, one can imagine that one does not know that the universe is life-permitting by imagining that one knows the number of particles in the universe, what types they are, and their intrinsic properties, but one does not know the fundamental laws governing how these particles interact. Or, one can imagine that one knows the density of matter in each (medium-sized) region of space-time, but one does not know what types of particles exist in those regions, or how they interact. (There are many other possibilities as well; I leave it to the reader to generate other options.) On either of these scenarios, there would be many possible universes which are not life-permitting, and hence one would hold that our universe being life-permitting

provides evidence for the existence of God, in the sense that $P^*(G|L) > P^*(G)$. But nevertheless, $P^*(G|L) = P^-(G)$, because the fine-tuning evidence doesn't change one's assessment of the various non-life-permitting universes one deems possible. In supposing that one knows that various types of particles in existence, but not the fundamental laws, the fine-tuning evidence doesn't affect one's assessment of the probability of life-permitting universes. The fine-tuning evidence just focuses on one particular set of fundamental laws, whereas in the scenario imagined we are allowing for all logically possible fundamental laws that are compatible with the existence of those types of particles. Facts about the fundamental constants for our particular laws simply don't matter in that case. Similarly, in supposing that one knows the density of matter in each region of space-time, the fine-tuning evidence doesn't affect one's assessment of the probability of life-permitting universes. The fine-tuning evidence just focuses on one particular set of fundamental laws, whereas in the scenario imagined we are allowing for all logically possible fundamental laws that are compatible with the actual density of matter. In these scenarios, $P^+(G) = P^-(G)$, and the fine-tuning argument is unsuccessful.

How should we adjudicate between these various scenarios? The literature on the problem of old evidence is of no help—there are no agreed-upon prescriptions for how to generate one's ur-probability function. The proponent of the fine-tuning argument might attempt to argue that we should hold the laws of physics fixed, and just vary the values of the constants, because that will produce possible universes that are most similar to our actual universe. But this argument is no good—similarity judgments are notoriously context-dependent, and there are important senses in which a universe with the same number and types of particles as ours, or a universe with the same density distribution as ours, is more similar to ours than a universe which differs in the number and types of particles or the density distribution but holds the laws of physics fixed. I conclude that there is no requirement from rationality or considerations of reasonableness which forces one to generate ur-probabilities in the way proponents of the fine-tuning argument want one to. It follows that one is open to generate ur-probabilities via a scenario that renders ineffective the fine-tuning evidence.

The general point is as follows: when faced with the fine-tuning evidence, it is reasonable to not be surprised. We already knew that there are many possible universes that are not life-permitting, and yet are similar in certain ways to our actual universe. The fine-tuning argument encourages us to focus our attention on those possible universes that have the same laws of physics as ours, but different fundamental constants. But why not focus on those possible universes that have the same types of particles as ours, but different

fundamental laws? Or why not focus on those possible universes that have the same density distribution as ours, but different types of particles? Before I was faced with the fine-tuning evidence, I already knew that our universe was special, in the sense that there are many possible universes similar to ours in certain ways and yet not life-permitting. I already knew that, if God existed, God would have to choose to actualize our life-permitting universe from among a sea of similar non-life-permitting universes. I already knew that, if God did not exist, there's a sense in which we are lucky that the universe is life-permitting—there are many possible universes similar to ours which are not. The fine-tuning evidence doesn't change any of that, and hence the fine-tuning evidence doesn't change my probability for the existence of God.

6 Many universes

I believe that the reply I've given above is the strongest reply one can give to the fine-tuning argument. It is hard to argue this point, since I'd have to consider all possible stronger replies to the fine-tuning argument and show that they are all unsuccessful. Instead, I will consider two *prima facie* powerful objections to the fine-tuning argument, and I will show that they are mistaken.

The objections are based on the many-universes version of the fine-tuning argument, so I will start by explaining that version. Sometimes, the fine-tuning argument is construed not as an argument for theism, but as an argument for the existence of many universes. (See, for example, Rees [2000], pp. 164–7 and Smart [2003], pp. 18–21.) The thought is that the existence of our universe, with just the fundamental constants it has, is highly improbable if there is only one universe, but is highly probable if there are an infinite number of universes, where different fundamental constants obtain in the different universes. Thus, the existence of our universe provides evidence for the existence of many universes.

Now, instead of using the facts about fine-tuning as evidence for the existence of many universes, one might try to use the existence of many universes as a way of rejecting the theistic fine-tuning argument. I will examine two ways that one could attempt to do this.

First, one might try to reject the step in the argument which holds that $P^*(L|G) > P^*(L|\sim G)$. (In the many-universes context, it's best to take L to be the proposition that there exists a life-permitting universe.) Supposing that many universes exist, one could argue $P^*(L|\sim G)$ is high; even in the absence of a God we would expect there to exist a life-permitting universe. One could then argue that the existence of a God wouldn't make it any more likely for a life-permitting universe to exist, so $P^*(L|G) = P^*(L|\sim G)$.

The problem with this reply is that it relies on fully believing that there are many universes. It seems strange to have such a conviction; to the extent that there is evidence at all in favor of the existence of many universes, the evidence is weak. But as long as one assigns a probability < 1 to the hypothesis that there are many universes, the theistic fine-tuning argument will still have force. On the supposition that there are many universes, $P^*(L|G) = P^*(L|\sim G)$, while on the supposition that there is just one universe, $P^*(L|G) > P^*(L|\sim G)$; one's actual ur-probabilities will be a weighted average of the ur-probabilities obtained on those two suppositions, and hence $P^*(L|G) > P^*(L|\sim G)$. These considerations involving many universes could weaken the theistic fine-tuning argument, but they do not demolish it.

The second way to attempt to use the existence of many universes to reject the theistic fine-tuning argument is as follows. One could admit that the fine-tuning evidence seems to provide evidence for the existence of God, but one could hold that that once one considers the many-universes hypothesis, it turns out that the fine-tuning evidence provides evidence for the many-universes hypothesis instead.

The problem with this reply is that this is not how Bayesian confirmation works. If one has two hypotheses, H_1 and H_2 , and $P(E|H_1) = P(E|H_2)$, then it follows from Bayes' Rule that the ratio of the prior probabilities is preserved: $P(H_1)/P(H_2) = P(H_1|E)/P(H_2|E)$. The ur-probability of the existence of a life-permitting universe is presumably about the same on the supposition that God exists as it is on the supposition that many universes exist: $P^*(L|G) \approx P^*(L|M)$, where M is the many-universes hypothesis. It follows that $P^*(G)/P^*(M) \approx P^*(G|L)/P^*(M|L)$. Thus, if $P^*(M|L) > P^*(M)$, then we would expect that $P^*(G|L) > P^*(G)$; the evidence confirms both hypotheses.

I conclude that the theistic fine-tuning argument is a powerful argument; for example, it cannot be reasonably refuted by an appeal to many universes. Nevertheless, as described in the previous section, there are ways of resisting its force. It is reasonable to hold that the fine-tuning evidence does not provide evidence for the existence of God.

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