

Roger White (born 1967)

White is Professor of Philosophy at the Massachusetts Institute of Technology. He specializes in epistemology and the philosophy of science.

THE ARGUMENT FROM COSMOLOGICAL FINE-TUNING

A high-security combination lock is wired up to nuclear warheads that threaten to destroy the whole world. The bombs will be detonated unless several dials are set to a very precise configuration of values. Miraculously it turns out that the dials are delicately set within the tiny range that deactivates the bombs. Had they differed ever so slightly from their actual positions all life would be gone. Is this just a lucky accident, or might they have been adjusted that way on purpose?

The fanciful story is in certain respects analogous to the view presented by many contemporary physical cosmologists. We are told that our universe is “fine-tuned for life.” What is meant is roughly the following. For life to have any chance of evolving the universe must meet certain conditions. It turns out that these conditions are extremely stringent. Had the values of various physical constants differed ever so slightly from their actual values the universe would not have been hospitable to life. It is said that these crucial constants could easily have taken different values. If we were to witness another big bang, the new universe it created would almost certainly be a rather boring one. It might collapse within seconds, or contain nothing but hydrogen, or nothing but black holes. There is only the tiniest chance that the crucial particle masses and force strengths would take the precise values required for life to emerge. While there is room for controversy over the details, the picture sketched here is widely endorsed by experts in the field. Our question is what philosophical implications this might have.

To say that our universe is “fine-tuned” in this sense is not to imply that there is a Fine-Tuner, an intelligent agent who had a hand in setting the values of the physical constants. It is just to say that these constants happen to fall in the narrow range required for life to exist. However, that our universe meets the stringent conditions for life has been taken as the basis for contemporary version of the Argument from Design. There are many ways that such an argument can be developed in detail. I will consider just one way, which focuses on *explanation*. Here is an outline of the argument.

Fine-Tuning Argument (FTA)

1. If a fact E that we observe stands in need of explanation, and hypothesis H provides a satisfactory explanation of E that is better than any alternative explanation available, then E provides significant evidential support for H.
2. That our universe is hospitable to life stands in need of explanation.
3. That God adjusted the constants in order to allow for life to develop provides a satisfactory explanation for why our universe is life-permitting.
4. There is no comparably satisfying explanation of this fact available.
5. Therefore, that our universe is life-permitting provides significant evidential support for theism.

First, a couple of general points about this argument. The conclusion of this argument is not that there *is* a God, or even that all things considered it is most reasonable to believe that there is. The argument seeks only to establish an evidential connection between certain observed facts and theism. This makes the conclusion somewhat modest while far from trivial. Any assessment of theism will have to consider various considerations for and against. The FTA just focuses on one such consideration. Second, the FTA as presented here concerns the existence of God. Often discussions of cosmological fine-tuning focus on the more modest *design hypothesis*: that some kind of intelligent agent or agents influenced the values of the constants. (Theism is a specific version of the design hypothesis.) It can make sense to frame the issue this way, as the attributes of God according to traditional theism go well beyond what is required to explain the fine-tuning facts. Nevertheless, our focus here is on an argument for the existence of God, and insofar as the data support the existence of a designer they will also support the existence of God, even if much more is involved in an assessment of theism.

Let's consider the premises in turn. Premise 1 states a general principle of evidential support, a version of what is called Inference to the Best Explanation. The idea is a familiar one. Among the myriad facts that a detective is faced with, some stand out and compel her to ask "Why?" The plausibility of her case hinges on how well her hypothesis can explain these various clues. Similarly, we can't *see* electrons the way we do tables and chairs, and we weren't around to observe the origin of species. Why then should we believe in electrons or evolutionary theory? Because they provide the most satisfying explanation of certain striking facts that we do observe.

There is a distinction being appealed to here between facts that *stand in need* of explanation and those that don't. Some situations rightly compel us to ask *why* things are like so. We are compelled because we think there surely is some answer. For others an appropriate response may be, "That's just the way things are." Suppose I spill some soapy water and it splatters in some arbitrary shape on the floor. It need not have landed in the very shape that it did. There are indefinitely many

possible puddle shapes that might have been formed. But the fact that it landed in *this* very pattern does not strike us as in special need of explanation. The water had to land in some way, and this is just one of many ways it could have landed. While it is possible that there is more to discover here, nothing about the shape of the puddle compels us to seek further answers. It is a different matter when the soapy water is blown through a wire ring. Now a thin film of liquid forms a perfect sphere. Even without any understanding of chemistry and physics we are compelled to ask why it formed in this way. We have no doubt that there is some deeper explanation for why this occurred than that it just turned out that way. It is scarcely credible to be told, "Well, it had to be in some shape and on this occasion it happened to form a perfect sphere."

It needn't redound to the credit of a hypothesis that it can explain some fact that didn't strike us as needing explanation in the first place. We find some alphabet tiles scattered on the table reading "ANOW AWNVIUUEPOBN VNJSKNVJKEWN AJKFN." Might some undiscovered law of physics determine that they be arranged thus? More plausibly, might someone have arranged them to form a coded message? Perhaps. But their configuration gives us little reason to believe any such hypothesis, as their arrangement doesn't require much of an explanation in the first place. Finding the letters "O THAT THIS TOO TOO SOLID FLESH WOULD MELT THAW AND RESOLVE ITSELF INTO A DEW" is a different matter. It would be crazy to believe that the pieces happen to be arranged in this manner for no reason. Of course in this case the obvious explanation is that someone arranged them in order to spell a line from *Hamlet*. To the extent that this gives a satisfying explanation, we have reason to suppose that it is true.

The last point to note concerning the principle is that the degree of support that a hypothesis enjoys depends on how it compares with alternative explanations. The papers on my desk are not where I left them. Why? They could hardly move around by themselves. Perhaps an intruder was rifling through my stuff. This might well explain it, although it leaves us with the question of how he managed to get into a locked room on the ninth floor when there are no signs of forced entry. I notice the window is slightly ajar. A simpler explanation might be that a gust of wind blew the papers out of place. Only insofar as this provides a satisfying explanation is the case for an intruder diminished. I notice further that my financial documents are all left in one pile. The intruder hypothesis may explain this in a way that the wind cannot. And this might make it the more plausible hypothesis despite its other difficulties.

Does the fact that the universe is suitable for life stand in need of explanation as premise 2 asserts? It is not easy to say in general how we assess whether something needs explanation. In most cases it is just obvious. We don't need to apply some theory to see that spherical soap bubbles and meaningful strings of alphabet tiles require explanation. Rightly or wrongly, the cosmological fine-tuning argument strikes many scientists and philosophers the same way (including many with no sympathy for theism or any design hypothesis). If the fine-tuning of the constants does not strike you this way, then this version of the FTA may have little appeal for

you. While there isn't space here for a detailed argument that cosmological fine-tuning does call for an explanation, we can make some suggestive points. First, without some further explanation the fine-tuning of our universe is thought to be extremely *improbable*. If we were to witness a new big bang we should firmly expect it *not* to produce anything like a universe with stable stars and planets and enough of the right elements for life. But while this is part of what makes something call for an explanation, it can't be the whole story. It is highly unlikely that by tossing a handful of alphabet tiles on the table we will see the sequence "ANOW AWNVIUUEPOBN VNJSKNVJKEWN AJKFN," since there are trillions of possible sequences of that length. But this hardly calls for an explanation. Typically those facts that do call for explanation involve some further significant feature that makes them stand out among the alternative possibilities. The spherical soap bubble is a *simple geometrical figure*; most possible shapes of water are irregular splatters. The line from *Hamlet* is *meaningful*; most such sequences are gibberish. Perhaps what makes a universe with *life* stand out is that it is *valuable*, morally and aesthetically. Most of the possible outcomes of a big bang are pretty bleak, just vast lifeless space with some simple atoms floating about. That against all odds we have the vast panoply of living creatures we find here can seem extraordinary.

Before turning to consider possible explanations of fine-tuning, let's briefly consider a common suggestion as to why we shouldn't find it remarkable in the first place. It is sometimes said that we shouldn't be surprised that we find the constants to be fine-tuned for life, since if they weren't we wouldn't be here to observe them. Since we couldn't observe the constants taking other than life-permitting values, there is nothing puzzling about the fact that we find them to be so. The following story illustrates what is unsatisfying about this response. You are standing before a firing squad with fifty rifles aimed in your direction. To your astonishment, as the guns blast each bullet flies close by you, leaving you unharmed. Why did all the bullets miss? Was it just an accident? Surely this cries out for explanation if anything does. It cannot help to be told, "Well, if they hadn't all missed you wouldn't be alive to see it." While this is true, it does nothing to remove the mystery of how the bullets all managed to miss you. Whatever appeal this suggestion has seems to rest on the confusion of thinking that our observations of the fine-tuned constants are somehow *inevitable*, and hence not in need of any further explanation. It was not inevitable that we would observe the constants to be fine-tuned. What was inevitable was just that *if* we were to observe the constants at all, we would find them to be fine-tuned for life. But there was a slim chance that we or anyone else would be around to observe anything at all. That we are here to observe our good fortune remains as puzzling as ever.

If the fine-tuning facts do require explanation, can theism provide a satisfactory explanation, as premise 3 claims? Let's begin by considering the positive case before addressing some objections. We explain phenomena by appeal to the actions of rational agents all the time. Why do the letter tiles spell a line from *Hamlet*? Why were the dials set to the very combination that disabled the nuclear warheads? Why are

the financial documents on my desk sitting in one pile? In each case the answer is that an agent brought matters about on purpose. Many such explanations are utterly compelling, as good as any explanation of anything.

Of course in each of the last three cases it is a familiar *human* agent that we have in mind. While everyone must grant that there are overwhelmingly plausible explanations that appeal to human agency, numerous objections have been raised to explanations invoking *divine* agency. We will briefly look at just two of these. First, there is thought to be something suspiciously *too easy* about invoking acts of God to explain some puzzling phenomenon. An omnipotent being can bring about anything. So no matter what we find, we could in principle just point to it and say, "God did that." This gives rise to the suspicion that such appeals are in some sense *empty*. The worry is sometimes expressed in the slogan "Whatever can explain anything explains nothing."

But of course humans are capable of arranging letter tiles in any possible sequence, dials in any configuration, and papers in any order. No matter how we found the letters we could in principle say, "Someone put them like that." This observation does nothing at all to diminish the force of the explanation when the letters form meaningful sentences. The grain of truth behind the emptiness complaint might be illustrated by the following story. We read that some stranger Jane Smith just won the lottery. "Aha," I say. "What are the odds of that, given the millions that bought tickets? I'll bet the lottery was rigged in her favor. That would explain why *she* won out of all those players." One way to see what is silly about my conspiracy theorizing is to note that if Bob Brown or Suzie Jones had won instead, I could just as well have invoked a similar explanation to account for his or her good fortune. But what goes wrong here is not just that I *could* propose such an explanation no matter how the lottery turned out. The problem is that such an explanation is no more or less compelling in the case of Jane Smith's winning than any other. Her having won no more *stands in need* of explanation than any other possible outcome would. And this can only show that it does not require an explanation at all. For it can hardly be that no matter how the lottery turned out we would have reason to suppose that it was rigged. The crucial point is that there is nothing about Jane Smith that I'm aware of that makes *her* having won rather than someone else especially striking. Someone had to win, and it could just as well have been Smith as anyone else. It would be a different matter if she had won the last three lotteries, or if she had just taken a senior position at the lottery commission.

The charge of explanatory emptiness may carry some force if the observed features of the universe are no more in need of explanation than any other possible features, and if we were no less inclined to invoke divine design regardless of how the universe was. But the possible outcomes of a big bang do not equally call for an explanation. If instead of a universe suitable for life the big bang had yielded nothing but a bland lifeless cosmic soup, it would not strike us as in urgent need of explanation. Here it is significant that the existence of living creatures has value in a way that other possible outcomes do not. It is not unlikely that a benevolent, rational being would

prefer a universe hospitable to living creatures over, say, one containing nothing but thinly dispersed hydrogen atoms. Note that for the explanation to be compelling it is not necessary that on the basis of theism one could *predict* that the universe will be suitable for life, let alone that there will be creatures much like us. Supposing that a human agent is arranging some letter tiles hardly allows me to predict that they will spell “O THAT THIS TOO TOO SOLID FLESH WOULD MELT THAW AND RESOLVE ITSELF INTO A DEW.” There are billions of possible sentences that an agent might produce. We can’t even be so sure that the letters will form a *meaningful* string. This agent might just shuffle them about in meaningless ways that strike her fancy. Nevertheless, arranging the letters in a meaningful way is a plausible purpose that an agent might have. And that is enough to make a far more satisfying explanation than supposing that they fell in this order by accident. Similarly, if the creation of life is a plausible purpose that a rational agent might have, then theism may provide a satisfactory explanation of the fine-tuning of the constants, one that is far more satisfying than supposing that it just happened by accident.

A second objection notes that when we invoke *human* agency to explain things we understand quite well *how* this might occur, as we understand how humans function. Humans have brains, a nervous system, muscles, and limbs. We understand how such a being can manipulate wooden tiles or fiddle with dials. We haven’t the faintest grip on how a being like God can “set” the physical constants to within some range of values. To invoke God, the objection goes, is just to introduce a mystery and not to make any explanatory progress.

We can first note that the explanatory force of our appeal to human agents does not crucially depend on our understanding of human physiology. Long before we had the faintest clue as to how our brains and bodies work, we could understand that human agents were responsible for various phenomena we observed. A short conversation with someone is enough to make it abundantly clear that there is a thinking agent behind the sounds coming out of her mouth. This is just by far the most satisfying explanation of my observations even if I have no idea whether brains even exist let alone how they work or how mental activity is related to a physical body, or anything of the sort. To further evaluate the force of the current objection, it is useful to consider a hypothetical case. David Hume imagined there being a voice booming from the sky for everyone in the world to hear. We can elaborate the story and suppose that we also see the clouds shuffle about to create messages in all the languages on earth. The voice provides us with all sorts of extraordinary information that we can verify to be correct. It gives us a detailed explanation of a cure for cancer. It makes amazingly precise predictions about future events such as the exact time and location of every raindrop over the next week. We are able to converse with the mystery voice, and it appears to reveal knowledge and intelligence orders of magnitude beyond what any human could have. Now I hardly have a better grasp of how an agent might do all of this than I do of how an agent might “fine-tune” the constants to permit life. But this would do little to blunt my conviction that somehow, some kind of agent vastly more powerful and intelligent than any human is behind the voice from the sky. I can perfectly well understand *why* we

hear a voice in the sky (some kind of extraordinary agent is speaking) without much understanding of *how* this is achieved. I can similarly understand why the universe is life-permitting (God or some extraordinary agent made it so) without much of a grasp of how this could be done.

Even if theism can provide a satisfying explanation for the fine-tuning facts, the force of the argument will be diminished to the extent that there are plausible rivals. The argument is perhaps most vulnerable at premise 4, which claims that there is no comparably satisfying explanation available. What might an alternative explanation look like?

The most interesting proposal is that our universe is just one of very many universes, one part of a large “multiverse.” The constants on which life depends may vary randomly among the universes. Given a large enough number of universes, it is to be expected that at least one such universe will meet the conditions for life. To illustrate, suppose we take a handful of alphabet pieces and drop them on the table. The letters form a string of gibberish. We try it again. Another (different) string of gibberish. We try it again. We repeat the process trillions of trillions of times until eventually we find a line from *Hamlet*. Amazing? Hardly. This sort of thing is bound to happen sometime if you repeat the process enough times. Similarly, the supposition that there have been many random “attempts” at a fine-tuned universe would appear to give a satisfying account of what would otherwise seem extraordinary.

Should we suppose that there are multiple universes? Some argue that the observed fine-tuning of the universe itself provides evidence for the existence of a multiverse, just as others see it as evidence of divine design. There is reason to be dubious of this inference. Suppose we tossed the letter tiles and they spelled out a line from *Hamlet* on the first try. Does our observation give us reason to suppose that these pieces have been tossed on the table many times before by others, or that there are millions of people out there similarly tossing letter tiles? Surely not. Even if such a multi-toss hypothesis were plausible to begin with, the surprising outcome that we have observed does nothing to support the hypothesis further. The crucial point here is that while the occurrence of multiple tosses makes it likely that the letters will land in a meaningful sequence on some occasion, it is no more likely that we will find such a sequence on the one toss that we observe. Similarly with the universes. That there are other universes out there makes it no more likely that we will find the one universe that we observed to be fine-tuned. Putting the matter in terms of explanation, the answer to the question “Why is the universe that we observe fine-tuned?” is not “Because there are lots of other universes.” Even if they are out there, these universes have no bearing on what goes on in the universe that we see. So arguably our observations of a fine-tuned universe provide no evidence for the existence of other universes.

There could, however, be independent theoretical grounds to believe in a multiverse. Cosmologists are divided on whether there are such grounds. And even proponents of the multiverse admit that the matter is highly speculative. Still, it is worth considering how the FTA fares in the event that we do have reason to believe in a

multiverse, independently of the fine-tuning data. In this case it does seem that the FTA is undermined. However, I would suggest that it is not premise 4 that is threatened in this case but premise 2. The existence of a multiverse does not *explain* but rather *removes the need to explain* the fine-tuning of our universe. Once we suppose there are many universes, it is to be expected that at least one of these will be fine-tuned just by chance. The question of why it is that *this* one, the one that we inhabit, is fine-tuned loses its urgency. Like Jane Smith's winning the lottery, our universe could just as easily be a lucky one as any other, and there is nothing about our particular universe that makes it stand in special need of explanation.

I have hardly scratched the surface of the possible defenses, rebuttals, and replies concerning the premises of this argument, not to mention the other ways we might frame the whole issue. But I hope to have conveyed some of the intuitive force of the puzzle about fine-tuning as an argument for theism. The argument, I would suggest, carries considerable force, although the verdict may ultimately depend on the credibility of the multiverse hypothesis.

TEST YOUR UNDERSTANDING

1. The cosmological fine-tuning argument begins from the observation that the fundamental laws of nature appear to be "fine-tuned" to permit the existence of life. Say what this means.
2. The argument assumes as a premise that the fine-tuning of the fundamental laws "stands in need of explanation." Explain this claim and say why it matters for White's argument.

NOTES AND QUESTIONS

1. The worst arguments for the existence of God go like this: "Here is some marvelous fact. Science can't explain it. Therefore God exists." These arguments are bad because science makes progress. At any given stage in the development of science, there will be facts that science cannot explain. But in many of these cases, the explanation will be just around the corner, and even when it isn't, the success of science gives us reason to think that scientific explanation is possible in principle. When we are confronted with a fact that science cannot explain, the rational response is almost always, "Let's wait and see." Why isn't the cosmological fine-tuning argument just another appeal to this "God of the Gaps"?
2. The scientific basis for the cosmological fine-tuning argument is controversial. The key premise is a claim about the *fundamental* laws of nature, but we do not know the fundamental laws, so any such claim is at best conjectural. For a review of some of the relevant facts, see Paul Davies, *Cosmic Jackpot: Why Our Universe Is Just Right for Life* (Penguin, 2006).