ACCEPTING THE UNIVERSE

Hugh Mellor

Hugh Mellor examines both the fine-tuning argument and the suggestion that this is but one of many universes within a great 'multiverse'.

The fine-tuning argument

We know that we can only survive in a very limited range of environments. Our surroundings must be neither too hot nor too cold, and must contain oxygen, water, and edible plants or animals. If our planet lacked any of these or many other prerequisites of human life, we would die out. So however many planets our universe contains, human beings will only be found on those that have all the features needed for them to survive. It can, therefore, be no surprise that the earth has all these features. For had it not been 'fine tuned' for human life in this way, we would not be on it, but on some other planet that did have what we require.

There is no mystery here, and no one thinks there is. But that may be because we think our universe contains a vast number of planets, of many different kinds. So however unlikely it may be that any one planet, picked at random, will have all the features we need, it is very likely that at least some of them will. This is as unsurprising as the fact that, however unlikely a coin is to land on edge on any one toss, it is almost certain to do so at least once if tossed often enough – provided of course that it *can* land on edge. Similarly with planets: to make it almost certain that some of the myriad planets in the universe can support human life, it must at least be possible for a planet to do so. In other words, the laws of nature must not rule out that possibility. But this can be no surprise either, for the very fact of our existence shows that the laws of nature cannot rule it out, since what is actual must also be possible.

But now suppose we thought our earth was the *only* planet in the universe, and also that it could have been different in many ways, nearly all of them making it unfit for human habi-

tation. In that case, should we not be even more surprised that the universe's one and only planet should be inhabitable than we are to see a single coin toss land on edge? And if we are, should we not accept a hypothesis whose truth would make this fine tuning more likely, namely that the universe was deliberately tuned by a competent designer? This may not prove that hypothesis, any more than a coin toss's landing on edge proves that it was made to land that way, but it does seem to support the idea.

Suppose it does, but suppose also that, while accepting the fact of fine tuning, we wish for some reason to reject the designer hypothesis. How may we do so? One way is by denying the other assumption of the above inference from fine tuning to a designer, namely that there is only one planet. If the universe contains enough planets, and coins are tossed often enough, the improbability of any one planet being inhabitable, or of any one coin toss landing on edge, can show up in the fact that nearly all planets are uninhabitable, and hardly any coin tosses land on edge. When that is so, the mere fact that some planets are inhabitable, and some coin tosses land on edge, does nothing to support a designer hypothesis.

So far so good, but also so uninteresting. But now suppose we rerun the fine-tuning argument, only with the earth replaced by our whole universe. For if the earth is finely tuned for life, so must our universe be. Our universe's so-called 'initial conditions' (the Big Bang) could conceivably have been different, as could the basic laws and constants of nature that govern its later evolution. And nearly all of these conceivable alternative laws, constants and conditions would make inhabitable planets not merely unlikely but impossible. The details may be complicated, but we needn't go into them here, since no one denies that our universe is in fact finely tuned for life. But while there are also in fact many planets, there is, almost by definition, only one universe. In this case, therefore, the other premise of the fine-tuning argument for a designer seems to be true. How then may we resist its conclusion?

The multiverse

The resistance I wish to discuss is that provided by the so-called 'multiverse' hypothesis advocated by Martin Rees and others. This hypothesis says that our universe is only one of many universes, just as the earth is only one of many planets. And the argument for the hypothesis is that cosmological theories which include it are supported by their making the fact of fine tuning far less surprising than it would otherwise be. The argument is just like that given above: it is incredibly unlikely that only one universe should as be finely tuned for life as ours is, but very likely that at least one of a vast number of universes would be.

To state this argument properly, we must first fix some terminology. First, 'our universe' cannot here mean 'everything that exists' or there could not, by definition, be more than one of it. To give the multiverse hypothesis a fair wind, we must take *our* universe to be something like everything, past, present and future, in the single spacetime whose earliest point is our Big Bang. But then we need another term for everything that exists anywhere, i.e. in some spacetime or other; and as it would beg the present question to call this 'the multiverse', I shall call it '*the* universe'. The question then is this: does *the* universe include more than *our* universe? Does it include other spacetimes, with different laws, constants and/or initial conditions, most of which would not, unlike ours, permit life as we know it?

Here is how Rees puts the fine-tuning argument for the hypothesis that it does.[1] He starts with the undeniable fact that 'a degree of fine tuning — in the expansion speed, the material content of the universe, and the strengths of the basic forces — seems to have been a prerequisite for the emergence of the hospitable cosmic habitat in which we live' (p. 212). To the fact of this 'seemingly special cosmic recipe' he then offers us three responses: 'we can dismiss it as happenstance; we can acclaim it as the workings of providence; or (my preference) we can conjecture that our universe is a specially-favoured domain in a still vaster multiverse.' (p. 212).

Neglecting 'providence' (his word for a designer), Rees prefers the multiverse because he thinks it does, as 'happenstance' does not, explain the fact of fine tuning. The reason it does so is that it contains so many possible features in some universe or other. It is, as Rees puts it, like 'an "off the shelf" clothes shop: if the shop has a large stock, we're not surprised to find one suit that fits. Likewise, if our universe is selected from a multiverse, its seemingly designed or fine tuned features wouldn't be surprising.' (p. 214)

To assess this argument I must first make a point about explanation. When and why do we take events, or facts, to need, and to get, explanations? The answer is that we generally want explanations only of events that we think did not *have* to happen, or of facts that we think did not have to be facts. This is why giving explanations is more important in science and history than it is in pure mathematics: for there, proving that something is so, e.g. that there is no greatest prime number, also shows that it had to be so; and this leaves no gap, between what is so and what has to be so, for further explanation to fill. Whereas in science and history, as in everyday life, we can and often do know that something is so without knowing that it had to be. That is the gap we want explanations to fill, which is why, for example, events are best explained by causes that make them inevitable.

However, some events have no such causes or, if they do, we cannot find them. We may still take these events to be explained by others which, while not making them inevitable, do significantly raise their probability. This is how smoking explains the cancers that smokers get, even though some smokers do not get cancer and some non-smokers do: the greater incidence of cancer among smokers makes us think that people are more likely to get it if they smoke than if they don't.

The multiverse hypothesis must therefore take life to be far more likely to arise somewhere in a multiverse than in our universe on its own. Otherwise the hypothesis will explain fine tuning no better than the 'single universe' hypothesis does. And then the fact of fine tuning will still support a designer

hypothesis, in this case the hypothesis that the multiverse was designed, and we should be no further forward. This is why advocates of a multiverse assume without argument that life is almost certain to arise somewhere within it.

But for this assumption to give a serious explanation of fine tuning, it must itself be a serious assumption, and it may not be. Suppose, for example, it is taken to follow from the assumption that anything which *can* exist *will* exist in some universe or other. Since we know that life can exist, because it does, this assumption makes life not just likely but certain to exist in any multiverse. But why should we accept *this* assumption? We must not accept it because we take all the universes other than ours that the multiverse contains to be merely *possible* universes. For then, if the multiverse contains *all* possible universes — and why not? — of course it will contain anything that *can* exist, merely by definition. But then the multiverse hypothesis would be no news, and no use, since we already think our universe *could* have differed from the way it is, in particular by lacking life: that after all is why we want to know why it *has* life. So for the multiverse to offer a serious alternative to a designer, the universes it contains, other than ours, cannot be merely possible. They must all be as actual as ours is, and the probability that life exists in some of them must therefore be high, not as a matter of the logic of possibility but as a matter of actual fact.

Two kinds of probability

So far still so good for the multiverse hypothesis. But the two probabilities it postulates — the low one of life arising in a single universe and the high one of it arising in a multiverse — may still not explain the fact fine tuning. They will only do so if they are probabilities of the kind that can provide probabilistic explanations, and it is not obvious that they are.

Take the probabilistic link between smoking and cancer. My smoking will only explain my getting cancer, if I do, by making it more probable, if that probability is a real *physical* probability (or *chance* for short). It is not enough for my smoking merely to raise my cancer's so-called *epistemic* probability, the

kind of probability that measures how far evidence supports a hypothesis. After all, that probability is also raised by the symptoms which tell my doctor that I have cancer. But these symptoms do nothing to explain my getting cancer, because they are not what raised the chance of my getting cancer in the first place.

Now apply this distinction between chances and merely epistemic probabilities to the case of a tossed coin landing on edge. Suppose I see this happen, the lighting and my eyesight are good, I am sober and there are no conjurers around. These facts, by making my vision reliable, make my seeing this event raise the epistemic probability that it really happened, perhaps even to 1. In other words, in these circumstances the evidence of my senses may reduce the epistemic probability that the event did *not* happen to 0. Yet, as with my getting cancer, this fact does not *explain* why the event did happen, because it tells us nothing about its chance of happening. This is why my seeing a coin land on edge makes me no less surprised that it did so, since what made that surprise me was my belief, which the evidence of my senses does nothing to change, that the coin had a very low chance of landing on edge. All that event's high epistemic probability tells me is that it *did* happen, not *why* it happened.

What then can explain events by raising their chances? The answer is that what raises or lowers the chance of an event, thereby making it less or more surprising, is an earlier event, such as a coin's being tossed or someone's smoking. This is why earlier events explain later ones but not *vice versa*. It is also why the initial state, if any, of a universe, or of a multiverse, which by definition lacks precursors, has no physical explanation, since there is nothing earlier to give it any physical probability, high or low.

Nor can a universe's basic laws and constants have physical probabilities. That is not because these laws and constants are not events but because they are *basic*, meaning that they do not follow from other laws or constants. The reason this stops them having chances is that it is only probabilistic laws of nature that fix the chances of other things. So because basic

laws and constants do not follow from anything else, and in particular not from other laws that could give them chances, they can no more have physical — as opposed to merely epistemic — probabilities than initial conditions can.

An improbable argument

We can now return to the multiverse hypothesis. To recap, the fine-tuning argument for it runs as follows. It is very surprising that a single universe should have a combination of initial conditions, laws and constants that lets it support life if it has not been designed to do so. What makes this so surprising is the improbability of a single undesigned universe having such a combination. But it is not at all improbable that one of many universes should do so, and therefore that life should arise in an undesigned multiverse. That is how the multiverse hypothesis claims to explain the existence of life without having to postulate a designer.

The question now is what 'improbable' means here. If initial conditions, and basic laws and constants, have no physical probabilities, it can only mean 'epistemically improbable'. Yet relative to the empirical evidence which tells us what these features of our universe are, they are not at all epistemically improbable: on the contrary, they must, by hypothesis, have a very high epistemic probability. Only if we ignore this evidence, and take the epistemic probability of these features relative only to logic, and perhaps to a few basic assumptions of physics, can they be epistemically improbable. And that, let us suppose, they are.

What does the difference between these two epistemic probabilities show? Compare my surprise at seeing a coin land on edge. Relative to my seeing it, this event has a very high epistemic probability. Relative merely to the coin's geometry, its epistemic probability is very low, perhaps because very few of a tossed coin's many equally possible trajectories would make it land on edge. But whatever makes that epistemic probability low, it is, as we have seen, not what makes me surprised to see the coin land on edge. What makes that event surprise me is my belief that it had a low *chance* of happening,

because of how I think the coin was tossed. So what *would* remove my surprise, by giving a really good explanation of the coin's ending up on edge, is discovering that it was *placed* on edge, i.e. that, unknown to me, there was a mechanism that gave this event a high physical probability.

But this is not what the multiverse hypothesis provides. All it provides is a large set of combinations of initial conditions, laws and constants, very few of which let a universe which has them support life. This may well show that, relative to no evidence about which of these combinations our universe has, the epistemic probability of its being one that supports life is very low. But this should not make us surprised that, relative to the evidence that now tells us what the initial conditions, laws and constant of our universe are, their epistemic probability is very high. All this shows is that they very probably are what our evidence makes us believe they are. But this, as our cancer and coin tossing examples show, is not enough to make that evidence *explain* what it justifies us in believing. Only something which raises the physical probability of what we believe will do that; and that the multiverse hypothesis cannot supply, since what it claims to explain has *no* physical probability, high or low, for anything to raise.

Facing the firing squad

To confirm that the multiverse hypothesis really cannot do what it claims to do, consider a well-known example quoted by Rees:

> Suppose you are facing a firing squad. Fifty marksmen take aim, but they all miss. If they hadn't all missed, you wouldn't have survived to ponder the matter. But you wouldn't leave it at that: you'd still be baffled, and you'd seek some further reason for your luck (p. 213).

Well, maybe you would; but only because you thought the ability of the firing squad, the accuracy of their weapons, and

their intention to kill you, made their firing a mechanism that gave you a very high chance of dying.

So now suppose there is no such mechanism. Imagine, as Bertrand Russell once did for other reasons, that our universe, including all our memories and other present traces of our apparent past, actually started five minutes ago. Then imagine in particular that it started with these fifty bullets coming past you, but with no prior mechanism to give their trajectories any physical probabilities, high or low. Suppose, in other words, that these trajectories really were among the *initial* conditions of our universe. If you thought that, should you really be baffled and seek some further reason for your luck? I say not; and I say too that, if you were still baffled, it should not reduce your bafflement to be told that the initial conditions of many other universes included similar swarms of bullets, most of which end up *hitting* people. On the contrary, if that information affected you at all — which admittedly it shouldn't — it would surely make you more baffled, not less, that your swarm missed you.

The fact is that the intuition behind multiverse theories is mistaken. It is like the intuition behind the so-called gambler's fallacy that, for example, the longer an apparently normal coin goes on landing heads, the more likely it is to land tails next time. That intuition, common though it may be among unsuccessful gamblers, is simply wrong. For if a coin's repeatedly landing heads tells us anything, what it tells us is that the coin is biased toward heads and is therefore more, not less, likely to land heads next time than we previously thought.

In short, what the intuition behind the gambler's fallacy needs is not an explanation of why it is right, since it isn't. What that intuition needs is not a theory to justify it but some therapy to remove it. The same goes for the intuition that the fine tuning of a single universe is physically improbable: physically, it is neither probable nor improbable. So we should not be trying to justify this intuition by postulating a multiverse that would raise the physical probability of fine tuning, since it would do no such thing. Rather, we should take to heart

Thomas Carlyle's alleged response to one Margaret Fuller's reported remark that she accepted the universe: 'Gad', said Carlyle, 'she had better'. And so had we.

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Note

[1]. In his 'Other Universes: a Scientific Perspective', in Neil A. Manson (ed.), *God and Design: The Teleological Argument and Modern Science* (London: Routledge, 2003) p.p. 211–20.