

## 14 B THE MULTIVERSE

### Introduction

The extent and detail of “fine-tuning” compatible with life on earth points to an intelligent Creator. For those who can’t stomach the idea of God an alternative explanation has been developed: The existence of an infinite number of parallel universes, each differing by only a single detail, in which we happen to live in the “lucky universe,” the only one compatible with life.

The reasoning goes like this: The fine-tuning in our universe is highly unlikely, but if we had an infinite number of possibilities then one of the universes will turn out to be our own, “just right” for life on earth.

*On the fine tuning of the universe, physicist Andrei Linde has said, “We have a lot of really, really strange coincidences, and all of these coincidences are such that they make life possible.” Linde stated this in a 2008 Discover article and added that the multiverse theory was a very compelling possibility for answering the question about the universe’s fine tuning, which permits life on earth. [1]*

Peter May writes-

*(Richard) Dawkins is quite dismissive of the fine-tuning argument. He states the problem correctly: “Physicists have calculated that, if the laws and constants of physics had been even slightly different, the universe would have developed in such a way that life would have been impossible.” This mystery has become known as the Goldilocks Enigma, because the universe appears to be ‘just right’ for us in the same way as the little bear’s porridge, chair and bed were all ‘just right’ for Goldilocks in the children’s story.*

*Dawkins concludes, “As ever, the theist’s answer is deeply unsatisfying, because it leaves the existence of God unexplained. A God capable of calculating the Goldilocks values ... would have to be at least as improbable as the finely tuned combination of numbers itself, and that is very improbable indeed.” He is left marvelling at the number of people who seem genuinely satisfied by the ‘Divine Knob-Twiddler’ argument, as he crudely puts it.*

*Let us then revisit the argument. For the universe to exist as it does and allow intelligent life to exist, it requires an astonishing series of ‘coincidences’ to have occurred. Stephen Hawking suggested that it is like a hoard of monkeys hammering away on typewriters and by pure chance eventually producing one of Shakespeare’s sonnets...*

*The most popular explanation and the one that appeals to Dawkins, is the ‘multiverse’. The idea here is that, unbeknown to us, there are other universes, all slightly different, so that it becomes more likely that in that number, a universe like ours might exist. (Paul) Davies wrote, “The multiverse theory seeks to replace the appearance of design by the hand of chance...” [2]*

## Origin of the Concept

The concept of a multiverse arose from physicist Hugh Everett's theory, the "many-worlds" interpretation of quantum mechanics (published as his Princeton Ph.D. dissertation). Everett was faced with the seeming contradictions of quantum mechanics (particle/wave duality, Heisenberg uncertainty, Schroedinger's cat, which is only statistical, neither alive nor dead). His solution: At every collapse of the wavefunction, the universe splits into all possible possibilities.

*Everett proposed a daring new explanation. Everett claimed that our universe —the universe we see, the universe of rocks and trees and people and galaxies out in space- was just one of an infinite number of universes, existing side by side. Each one of these universes was constantly splitting, so there was a universe where Hitler lost the war, and another where he won; a universe where Kennedy died, and another where he lived. And also a world where you brushed your teeth in the morning, and one where you didn't...His explanation was consistent with the quantum equations, but physicists found the idea hard to accept. They didn't like the idea of all these worlds constantly splitting all the time. They found it unbelievable that reality could take this form. [3]*

Everett didn't actually describe the conditions of the alternative universes in his writing. Everett's original thesis was highly mathematical and implied a "splitting" of reality without using the actual word. The universal wave function, composite state functions, probability density functions, superposition, and correlation led to a mathematically consistent approach to quantum mechanics.

Kiger expands:

*In quantum theory, an elementary particle such as an electron doesn't exist in a single state, but rather in a superposition— that is, a multiplicity of locations, velocities, and orientations. But in the macroscopic (visible to the naked eye) level of things that we can observe and experience, objects seem to exist in just one state at a time. How does our world result from all those possibilities?*

*Everett, a creative thinker if there ever was one, got a brainstorm that was at once both brilliant and bizarre. Here's a greatly oversimplified version: Instead of a single reality where everything existed in just one of its many possible states, Everett imagined a multiverse, full of different realms in which all the possibilities dictated by quantum mechanics could exist at once...*

*In the decades that followed, Everett's notion of a multiverse has gradually gained credibility among physicists. Moreover, it has ensconced itself into popular culture as a frequent theme in science fiction, and become a subject of fascination for scores of ordinary folks who don't know or care anything about the nuances and paradoxes of quantum theory. After all, it's mind-blowing to imagine that every choice we make in life —from the person we marry, where we*

*live, what color we dye our hair, what we eat for lunch — spawns a separate universe in which another version of ourselves did something different. [4]*

In a 1957 letter to Bryce DeWitt Everett wrote-

*The theory is in full accord with our experience (at least insofar as ordinary quantum mechanics is). It is in full accord just because it is possible to show that no observer would ever be aware of any "branching," which is alien to our experience as you point out...*

*From the viewpoint of the theory, all elements of a superposition (all "branches") are "actual," none any more "real" than another. It is completely unnecessary to suppose that after an observation somehow one element of the final superposition is selected to be awarded with a mysterious quality called "reality" and the others condemned to oblivion. We can be more charitable and allow the other to coexist—they won't cause any trouble anyway because all the separate elements of the superposition ("branches") individually obey the wave equation with complete indifference to the presence or absence ("actuality" or not) of any other elements. [5]*

In the footnote to his paper Everett wrote:

*The whole issue of the transition from "possible" to "actual" is taken care of in the theory in a very simple way—there is no such transition, nor is any such transition necessary for the theory to be in accord with our experience. From the viewpoint of the theory all elements of a superposition (all "branches") are "actual," none any more "real" than the rest. It is unnecessary to suppose that all but one are somehow destroyed, since all the separate elements of a superposition individually obey the wave equation with complete indifference to the presence or absence ("actuality" or not) of any other elements. This total lack of effect of one branch on another also implies that no observer will ever be aware of any "splitting" process.*

*Arguments that the world picture presented by this theory is contradicted by experience, because we are unaware of any branching process, are like the criticism of the Copernican theory that the mobility of the earth as a real physical fact is incompatible with the common sense interpretation of nature because we feel no such motion. In both cases the argument fails when it is shown that the theory itself predicts that our experience will be what in fact it is. (In the Copernican case the addition of Newtonian physics was required to be able to show that the earth's inhabitants would be unaware of any motion of the earth.)[6]*

Brian Greene writes that the mathematics seems to drive us towards the concept of a multiverse. [7]

## Forms of the Multiverse

Physicist Max Tegmark postulates four levels of possible multiverse based on inflation theory and mathematical symmetry: [8]

Level One- Inflation predicts Level I parallel universes (possessing the same laws of physics as those we operate with).

Level Two –Inflation plus landscape predict Level II parallel universes, which could have different laws of physics.

Level Three- “Collapse-free” quantum mechanics predict Level III parallel universes, which could have different parts of quantum Hilbert space.

Level Four- Tegmark’s “external reality” hypothesis predicts Level IV parallel universes, which could have all mathematical structures corresponding to different fundamental laws of physics.

Brian Greene suggests nine possible forms of a multiverse: [9]

- Quilted
- Inflationary
- Brane
- Cyclic
- Landscape
- Quantum
- Holographic
- Simulated
- Ultimate

## Problems with the multiverse

### Physical Problems

1. A universe could exist in which the normal laws of physics don’t exist: no fields, no forces, no entropy. A universe could exist in which quantum mechanics does not exist.

2. Instead of explaining fine-tuning, the multiverse may actually require fine tuning.

*Some multiverse models require an element of fine-tuning for there to be a multiverse in the first place. An example is that the overall mean density must be less than or equal to the critical value so that the universe as a whole is infinite and expands forever. And that may not be likely given that in principle the density can take any value from an enormously large range. It might be far greater than the critical value, in which case the universe is not infinite, but finite. [10]*

3. Since the universes are absolutely parallel, with no known points of contact, it is impossible to detect, observe, or to verify the existence of another universe.

*(I)t must be understood that there is no hard evidence at all for the existence of any other universes and, if they exist, we would never be able to see them or have any contact with them. Can this then be considered a scientific idea if it cannot be tested by experiment or observation? Davies states, “It can be validly objected that a theory which rests on entities that are in principle unobservable cannot be described as scientific.” [11]*

4. The multiverse is based on levels of probability.

*William Lane Craig commented-*

*If our universe is but one member of a multiverse, then we ought to be observing highly extraordinary events, like horses' popping into and out of existence by random collisions, or perpetual motion machines, since these are vastly more probable than all of nature's constants and quantities' falling by chance into the virtually infinitesimal life-permitting range.*

*Observable universes like those strange worlds are simply much more plenteous in the ensemble of universes than worlds like ours and, therefore, ought to be observed by us if the universe were but a random member of a multiverse of worlds. Since we do not have such observations, that fact strongly disconfirms the multiverse hypothesis. On naturalism, at least, it is therefore highly probable that there is no multiverse. — (Roger) Penrose puts it bluntly “these world ensemble hypothesis are worse than useless in explaining the anthropic fine-tuning of the universe”. [12]*

5. The fact that the multiverse seems to fit mathematically (assuming inflation theory and string theory are valid) doesn't insure that it's true. Mathematical symmetry does not always equate to existence.

6. The multiverse requires an infinite number of solutions. No other theory actually requires the use of infinity.

7. The multiverse is not the simplest explanation. (Occam's razor concept) In fact, it's the most complicated possible solution.

8. There is no way to detect the alternate universes. It is strictly a conjecture.

*Craig writes-*

*The first point is that there isn't any compelling evidence that a multiverse of the sort required to explain fine-tuning exists. Here it's very important to understand that it's not enough just to have a multiverse...You need a multiverse of a very special kind, namely, it needs to be infinite (it has to have an infinite number of worlds) in order to guarantee that finely-tuned worlds will appear, and then secondly the constants and quantities need to be randomly ordered in order to guarantee that every alternative will be tried. That's what people are talking about when they say there's no evidence of a multiverse. When a cosmologist like George Ellis indicts the multiverse hypothesis by saying there's no evidence for it, he doesn't just mean there's no evidence of any ol' kind of multiverse. He means there's no evidence of the kind of multiverse that is required in order to explain away fine-tuning. [13]*

9. The apparently scientific explanation for the existence of a multiverse posits the multiple universes based on the many-worlds hypothesis, quantum fluctuations and inflation, and string theory, none of which are universally accepted by physicists.

10. It ultimately denies a real observer and real scientific facts.

*Philip Ball concludes-*

*What the MWI [Many Worlds Interpretation] really denies is the existence of facts at all. It replaces them with an experience of pseudo-facts (we think that this happened, even though that happened too). In so doing, it eliminates any coherent notion of what we can experience, or have experienced, or are experiencing right now. We might reasonably wonder if there is any value — any meaning — in what remains, and whether the sacrifice has been worth it...*

*Properly conceived, it is saying that there are neither facts nor a you who observes them.*

*It says that our unique experience as individuals is not simply a bit imperfect, a bit unreliable and fuzzy, but is a complete illusion. If we really pursue that idea, rather than pretending that it gives us quantum siblings, we find ourselves unable to say anything about anything that can be considered a meaningful truth. We are not just suspended in language; we have denied language any agency. The MWI — if taken seriously — is unthinkable.*

*Its implications undermine a scientific description of the world far more seriously than do those of any of its rivals. The MWI tells you not to trust empiricism at all: Rather than imposing the observer on the scene, it destroys any credible account of what an observer can possibly be. Some Everettians insist that this is not a problem and that you should not be troubled by it. Perhaps you are not, but I am. [14]*

Philosophical problems:

Multiverse theory leads to some strange consequences:

1. No person would be unique. Other universes would have copies of you, identical except for some small feature or action.

In some other universe you might be thirty feet tall and have green hair. David Berlinski notes that physicist Max Tegmark is convinced that the multiverse is reality, even “if in some other universe he is persuaded that it is not so...” [15]

2. If every imaginable possibility exists in some universe, there would be a universe in which dragons, fairies, Santa Claus, and the Easter Bunny exist.

3. The difficulty with building on Hugh Everett’s theory: It takes a sub-atomic observation and applies it to human choices at a macro-level.

4. Even if the multiverse were ever proven true, it still doesn’t solve the problem of origins. Where did the whole multiverse come from? Did God actually create a multiverse but chooses to interact personally with our universe?

*(John) Lennox says that while he is “not really impressed” by the theory of a multiverse, he believes the idea of multiple universes is entirely compatible with belief in God. “Even if you granted multiverse,” he says, “it doesn’t prove that God doesn’t exist. God can create as many universes as he wishes, as many a philosopher, atheists included, has pointed out.” [16]*

5. Multiverse theory leads to logical absurdities.

*If the multiverse theory is true, it would not only explain this improbability, but it could explain every conceivable improbability. Oxford mathematician John Lennox humorously writes, "I am tempted to add that belief in God seems an infinitely more rational option, if the alternative is to believe that every other universe that possibly can exist does exist, including one in which Richard Dawkins is the Archbishop of Canterbury, Christopher Hitchens the Pope, and Billy Graham has just been voted atheist of the year." [17]*

Spiritual problems:

1. If there actually were an infinite number of parallel universes, there would be a universe in which free will and sin didn't exist, a universe in which Adam never sinned, a universe in which Israel didn't leave Egypt, a universe in which Jesus refused to go to the cross. Would God design/allow such universes?

*The theological implications of a multiverse creation are intense. What does it do to our vision of God, if God's creative power extends beyond our spacetime? What does it do to our understanding of the Bible narrative, and to our understanding of providence and the purpose of being? The ramifications go well beyond what a single work could sanely manage. [18]*

2. The mere existence of a multiverse would not explain away the existence of God.

Don Page writes that God loves the multiverse. God could have created more than one universe. That doesn't change what happened in this universe in any way. [19]

3. The reality of God is actually a more reasonable explanation for an infinite number of universes than naturalism would be.

William Lane Craig:

*(The point) that I wanted to make is one made by the philosopher Michael Rota who was also involved in team teaching this course at St. Thomas on fine-tuning. What Rota argues is that the multiverse is actually more probable on theism than it is on naturalism. He says on a theistic version of the multiverse hypothesis the proportion of life-permitting universes will be much larger. This means that it's much more to be expected that our universe would be life-permitting on a theistic multiverse hypothesis than it is expected to be on in an atheistic multiverse hypothesis. If the atheistic multiverse hypothesis were true, he says, some rational observers somewhere in the multiverse would almost certainly exist but it very probably would not have been us because our universe would very probably not have allowed life. So what Rota is saying is that if God exists and has created a multiverse he would probably make it such that observers would appear widely throughout the multiverse. God wants to create creatures after his own image that could know him. But on naturalism it's highly, highly improbable that the sort of life-permitting universes would exist. So ironically it turns out that the multiverse hypothesis is really more probable given the existence of God than it is given naturalism. So I don't think the multiverse hypothesis is a good or plausible alternative to cosmic design. [20]*

Gary Bates quotes writer Amanda Geffer, commenting on the two options of a Designer or a multiverse:

*“What might a third option look like here? Physicist John Wheeler once offered a suggestion: maybe we should approach cosmic fine-tuning not as a problem but as a clue. Perhaps it is evidence that we somehow endow the universe with certain features by the mere act of observation. It’s an idea that Stephen Hawking has been thinking about, too. Hawking advocates what he calls top-down cosmology, in which observers are creating the universe and its entire history right now. If we in some sense create the universe, it is not surprising that the universe is well suited to us.” [21]*

### Alternative Explanations

Victor Stenger is convinced that Everett’s MWI (Many Worlds Interpretation of Quantum Mechanics) does not imply a multiverse, but rather a single universe with working laws of physics, which “splits” into multiple worlds. [22]

Craig Rusbult, a believer, distinguishes between an infinite multiverse and an immense multiverse:

*Beating the Odds: In a 5-card hand of poker, getting a royal flush (XJQKA of same suit) is highly improbable, so the odds against it are high. But if you deal a large number of hands, observing a royal flush becomes highly probable, so the odds favor it. Similarly, the odds against a fine-tuned universe are extremely high, but if we live in a huge multiverse (containing many universes with varying properties of nature) having one or more life-allowing universes becomes highly probable so the odds favor it, and we live in one of these life-allowing universes.*

*Currently the most popular proposals for a multiverse claim theoretical support from cosmological inflation (early in the Big Bang) and string theory, but multiverse proponents acknowledge that direct observational evidence for their theory seems to be impossible, so we can ask “is it really science?” We should not think of a multiverse as an actual reality, but as a potential reality, a speculative proposal (with some scientific support) that we can imagine.*

*(Based on material by Robert Mann he suggests-)*

*There are important differences between an immense multiverse (where MANY THINGS happen) and an infinite multiverse (where EVERYTHING happens). The mathematics of infinity produces results that seem absurd in our normal non-infinite ways of thinking. An argument based on converting these mathematical absurdities into philosophical absurdities will seem much less impressive when we think about the important differences between an infinite multiverse (which is physically impossible, and would be very strange) and an immense multiverse (which might be possible, and would be less strange). [23]*

Physicist Stephen Barr offers a different take on the concept-

*The multiverse idea is very speculative and comes in a variety of versions. It does not necessarily posit the existence of “many universes,” as is widely supposed. The versions thought about by physicists all assume that the multiverse is a single universe governed by a single set of fundamental laws of physics. (In some versions, the universe can split and recombine, but nevertheless forms a single interacting system.) What makes a universe a multiverse is that the fundamental laws of physics have a flexibility that allows certain physical quantities and features that were traditionally thought to be the same everywhere throughout the universe to vary from one place to another within it.*

*For example, the strength of the strong force, the types of particles that exist and their properties, the value of “ $v$ ” and so on, might be different in different regions or “domains” of the universe. If there were a sufficiently large number of domains, there could be a high probability that in some of them all the physical quantities and qualitative features would be just right to make life possible...*

*Given that there might be a naturalistic explanation of some of the anthropic coincidences, does that mean that they do not in any way point to life being “built-in from the beginning”? Are we back to the idea that we are simply accidents in a vast and pointless cosmos? I do not think so, for the following reason. In order for the universe to have a multiverse structure, the fundamental laws that govern it must have enough flexibility to allow many important physical quantities and qualitative features of the universe to vary from place to place. That is a highly remarkable characteristic for the fundamental laws to have. There is no a priori reason to expect a universe to have laws that would make it a multiverse, let alone a multiverse with the enormous richness of possibilities that would make life possible.*

*The take-away lesson of the anthropic coincidences, then, is that if a universe is to be life-bearing, its laws must be very special in one way or another. They may be special in having many important quantitative and qualitative features be everywhere “just right” to allow life, or they may be special in allowing all these features to vary from place to place in the universe. Therefore, we should not at all take it for granted that the universe has the right properties to make life possible. It did not have to be that way. Rather, it should be a source of great wonder...*  
[24]

Some believe that physicist Alexander Vilenkin dealt a deadly blow to multiverse theory with a Cambridge paper-

*Many atheists and philosophical naturalists have hailed the multiverse almost as something like a god--describing its beauty, power, etc., with absolutely no proof that such a thing has ever existed. It is a strange stance to be sure for those who constantly criticize believers in God for having ‘faith’ in something that (supposedly) has no proof for its existence.*

*Prior to his most recent paper, Vilenkin (along with Arvind Borde and Alan Guth) had shown there was strong scientific evidence against a multiverse. Together, they demonstrated that any universe which has, on average, been expanding throughout its history cannot be infinite in the past but must have a past space-time boundary.*

*What makes their proof so powerful is that it holds regardless of the physical description of the universe. The Borde-Guth-Vilenkin theorem is independent of any physical description of that moment. Their theorem implies that even if our universe is just a tiny part of a so-called multiverse composed of many universes, the multiverse must have an absolute beginning. [25]*

## Conclusions

Scientists are divided on the concept of the multiverse. The problems associated with it seem larger than the explanatory value of the theory. “These other universes represent the ultimate example of an ‘undiscovered country’”, writes Nigel Brush, “a realm or realms totally separate from the everyday reality that we experience in this physical universe. In this sense, multiple universes are little different from the supernatural: their existence can never be proved or disproved [by science] since they lie outside the arena of scientific scrutiny.” [26]

*There is not one shred of empirical evidence for the multiverse theory. None at all. Even atheist Martin Rees (an ardent multiverse supporter) writes that the multiverse theory “is plainly still no more than a tentative hypothesis. In fact, he admits that “these universes would never be directly observable, even in principle. In a recent article from Scientific American, agnostic cosmologist George Ellis writes, “Even if the multiverse exists, it leaves the deep mysteries of nature unexplained... All the parallel universes lie outside our horizon and remain beyond our capacity to see, now or ever, no matter how technology evolves. In fact, they are too far away to have had any influence on our universe whatsoever. That is why none of the claims made by multiverse enthusiasts can be directly substantiated... We have no hope of testing it observationally.”*

*The fact that naturalistic scientists have invented such a theory only proves that these physical laws and constants demand some sort of explanation—even if it’s a bad one. [27]*

Sabine Hossenfelder writes-

*Why, then has the idea become popular? A cynic may argue that it’s because the multiverse offers infinitely new opportunities for paper writing. But I don’t want to feign hypotheses.*

*Let me stick to the facts: To our best knowledge, assuming the existence of any universe beyond our own is unnecessary to explain anything we have ever observed. In the best case, then, the multiverse is an interpretation. [28]*

Keating adds-

*(A)s G.K. Chesterton quipped: "When men stop believing in God, they don't believe in nothing; they believe in anything." For multiverse believers, this is literally true: the same scientists who reject God's existence due to lack of evidence pin their hopes on a theory so all-inclusive and vague it can never be refuted.*

*Those who believe God created the universe are intellectually honest enough to admit that they do so on the basis of faith. But those who believe in the multiverse are also keeping the faith. They just don't admit it. [29]*

The concept of the multiverse may seem appealing: We all ask “What if?” questions all the time - “What if I had done things differently?”, “What if I had taken this other path?” The theory of multiple worlds seems to open a way to explore that, but only in fiction. The multiverse itself seems to fit more with science fiction or comic book stories than with science. In billions of universes there are no star systems at all, and the standard laws of physics don’t hold. In one universe the sun is green, and the grass is blue. In another, you are left-handed instead of right-handed. Only God could know what all the unrealized possibilities would look like. We are tasked with living wisely in this one world we can actually experience.

Jeff Zweerink concludes his study of the multiverse: “If every possible situation occurs, no matter how improbable, on what basis does science operate? The idea that a model can be either falsified or verified by data provides a central theme in the scientific enterprise. Thus, by allowing for every possible situation, the multiverse ultimately explains nothing and undermines the whole scientific enterprise.” [30]

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