Fine-Tuned for Life: A Teleological Argument for God's Existence

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If you walked into your hotel room and heard your favorite music playing in the background, smelled your favorite scent filling the room, noticed your favorite beverage and snacks on the desk, your preferred brand of toiletries in the bathroom, and the TV tuned to your favorite channel, what would you conclude? You would conclude that *someone* knew *you* were coming.[1] This is an apt description of our universe. It is tailor-made for the existence of intelligent life. It's as if the universe knew we were coming. Let me explain.

WHAT IS FINE-TUNING?

The laws of physics describe our observations of the way the physical world operates. When we observe that some *x* always operates in the same way, we call it a natural law. The laws of nature have a mathematical form as well as a particular strength. The mathematical form describes what the law does, whereas the strength describes the precise value that the law takes on (determined by experiment). The strength/value of the physical law is described as its "constant" because the strength does not change. For example, the mathematical form describing how the law of gravity behaves is $F = Gm1m2/r\ 2$, but its value is "G," which tells you the actual strength of this force.[2]

If we could adjust the values of the physical constants, it would result in a different kind of universe. Scientists are able to model the kinds of universes that would exist when you keep the same physical laws but change their relative strengths/values.[3] As Stephen Hawking explains, "By examining the model universes we generate when the theories of physics are altered in certain ways, one can study the effect of changes to physical law in a methodical manner."[4] So in a possible world *w*, the law of gravity would still be $F = Gm1m2/r\ 2$, but its relative strength might be *G'* rather than *G.*[5]

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[1]Antony Flew and Roy Abraham Varghese, *There is a God: How the World's Most Notorious Atheist Changed His Mind* (New York: Harper One, 2007), 113-4.

[2]There are at least 47 physical constants, some of which include the gravitational force, the strong nuclear force, the weak nuclear force, the cosmological constant, the mass density of the universe, the mass of the neutrino, the electromagnetic force, the ratio of electrons to protons, the mass of up and down quarks, entropy, the velocity of light, the rate of proton decay, dark matter mass per photon, and the Higgs vacuum expectation value.

[3]Through modeling, physicists can determine how different strengths of the constants would impact the universe. If they discover that life could still exist if constant *x* changed by 0.0001 in either direction (stronger or weaker), but life would not be possible if constant *x* changed by .0003 in either direction, then constant *x* would be fine-tuned to 0.0002. To determine the level of fine-tuning exhibited in our universe, then, one must simply compare the life-permitting range for each constant to the non-life-permitting range. If the life-permitting range is large compared to the non-life-permitting range, then the likelihood of constant *x* assuming the value it did is high, but if the life-permitting range is extremely small compared to the non-life-permitting range, then the likelihood of constant *x* assuming the value it did is extremely low.

[4]Stephen Hawking, "Why God Did Not Create the Universe"; available from http://online.wsj.com/article/SB10001424052748704206804575467921609024244.html; Internet; accessed 04 September 2010.

[5]As Robbin Collins notes: "So when we conceive of worlds in which a constant of physics is different but in which the laws are the same, we are conceiving of worlds in which the mathematical form of the laws remains the same, but in which the

Imagine for a moment the existence of a universe-generating machine. It contains a bunch of dials representing each of the natural laws, and each dial has trillions upon trillions of possible settings (representing the range of possible values each law could take). If you randomly adjusted each of the dials and hit the universe generating button, what would happen? What scientists have discovered in the past ~70 years is that of all the possible strengths the constants could have assumed, only an extremely narrow range will permit the existence of intelligent life. Most configurations of our universe-generating machine will result in a universe that quickly collapses, a universe that expands too quickly, a universe with no matter, etc. Among the physically possible universes, only a tiny number would result in universes capable of producing and sustaining intelligent life.

The range of life-permitting values for the physical constants is unfathomably narrow. Only slight deviations from the actual values could be tolerated before life would become impossible. It just so happens that our universe contains the precise values necessary for the existence of intelligent life. When the range of life-permitting values is exceedingly small compared to the range of all possible values, scientists say the values of the constants are "fine-tuned."[6]

How do scientists determine the range of physically possible strengths for each natural law? They do so by establishing the upper and lower baselines, and then compare the actual strength of each constant to those baselines. The baselines are determined by the laws with the highest and lowest strengths. For example, for the fundamental forces, the strongest force is the strong nuclear force, weighing in at a strength of $1:10^{75}$. The weakest force is gravity, weighing in at a strength of $1:10^{40}$. Gravity, then, could have assumed a strength anywhere between its actual strength and a strength that is 10^{35} higher (the value of the strong nuclear force minus the actual value of gravity).[7]

SCIENTISTS AFFIRM THE REALITY OF FINE-TUNING

Before we get into specific examples of the finely-tuned parameters of the physical laws, it needs to be understood that there is a scientific consensus regarding the reality of fine-tuning. The only scientific debate over the issue is how to explain it. Here is a sampling of what scientists have had to say about the reality of fine-tuning and the difficulty it poses to naturalistic explanations of the universe. The famed, Stephen Hawking, had much to say on this topic. He wrote:

> The laws of science, as we know them at present, contain many fundamental numbers, like the size of the electric charge of the electron and the ratio of the masses of the proton and electron. … The remarkable fact is that the values of these numbers seem to have been very finely adjusted to make possible the development of life. For example, if the electric charge of the electron had been only slightly different, stars either would have been unable to burn hydrogen and helium, or else they would not have exploded [which allows elements necessary for life to be scattered]. … It seems clear that there are relatively few ranges of values for the numbers that would allow the development of any form of intelligent life.[8]

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experimentally determined numbers are different. It should be noted that the distinction between laws and constants need not be a metaphysical distinction, but only a conceptual distinction. Now these constants of physics are relative." [Robin Collins, "The Teleological Argument: An Exploration of the Fine-Tuning of the Universe," *Blackwell Companion to Natural Theology*, William Lane Craig and J.P. Moreland, eds. (Chichester, West Sussex: Wiley-Blackwell, 2009), 24.]

[6]Robin Collins, "The Teleological Argument: An Exploration of the Fine-Tuning of the Universe," *Blackwell Companion to Natural Theology*, William Lane Craig and J.P. Moreland, eds. (Chichester, West Sussex: Wiley-Blackwell, 2009), 244.

[7]Stephen C. Meyer, *The Return of the God Hypothesis: Three Scientific Discoveries that Reveal the Mind Behind the Universe* (New York: HarperOne, 2021), 138.

[8]Stephen Hawking, *A Brief History of Time* (New York: Bantam Books, 1998), 129-30.

And again:

> By examining the model universes we generate when the theories of physics are altered in certain ways, one can study the effect of changes to physical law in a methodical manner. Such calculations show that a change of as little as 0.5% in the strength of the strong nuclear force, or 4% in the electric force, would destroy either nearly all carbon or all oxygen in every star, and hence the possibility of life as we know it. Also, most of the fundamental constants appearing in our theories appear fine-tuned in the sense that if they were altered by only modest amounts, the universe would be qualitatively different, and in many cases unsuitable for the development of life. For example, if protons were 0.2% heavier, they would decay into neutrons, destabilizing atoms.[9]

And yet again, Hawking said the physical constants

> appear fine-tuned in the sense that if they were altered by only modest amounts, the universe would be qualitatively different, and in many cases unsuitable for the development of life…. The emergence of the complex structures capable of supporting intelligent observers seems to be very fragile. The laws of nature form a system that is extremely fine-tuned, and very little in physical law can be altered without destroying the possibility of the development of life as we know it. Were it not for a series of startling coincidences in the precise details of physical law, it seems, humans and similar life-forms would never have come into being.[10]

British cosmologist, Martin Rees, writes: "If we modify the value of one of the fundamental constants, something invariably goes wrong, leading to a universe that is inhospitable to life as we know it. … The conditions in our universe really do seem to be uniquely suitable for life forms like ourselves, and perhaps even for any form of organic complexity."[11]

Astronomer, Heinz Oberhummer, said "I am not a religious person, but I could say this universe is designed very well for the existence of life. The basic forces in the universe are tailor-made for the production of…carbon-based life."[12]

FOUR LEVELS OF FINE-TUNING

Fine-tuning appears at four different levels in the universe: (1) the initial conditions of the universe at the Big Bang; (2) the laws of nature; (3) the physical constants; (4) our solar system. Let's explore each level in turn.

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[9]Stephen Hawking, "Why God Did Not Create the Universe."

[10]Stephen Hawking and Leonard Mlodinow, *The Grand Design* (New York: Bantam Books, 2010), 160-61.

[11]Martin Rees and John Gribbin, *Cosmic Coincidences: Dark Matter, Mankind, and Anthropic Cosmology* (New York: Bantam Books, 1989), 269.

[12]Heinz Oberhummer, "Stellar Production Rates of Carbon and Its Abundance in the Universe," *Science* 289 (July 7, 2000): 88-90, quoted in Nancy Pearcey, *Total Truth: Liberating Christianity from Its Cultural Captivity* (Wheaton, IL: Crossway Book, 2004), 189.

Initial Conditions

Entropy

Disorder increases as you move forward in time. That means the universe was in its most ordered state at the Big Bang. This is what scientists call a "low entropy state." In the beginning, mass and energy were finely balanced. The initial distribution of mass-energy is referred to as entropy fine-tuning.

Cosmologist, Roger Penrose, calculated precisely how fine-tuned the initial entropy needed to be by comparing the number of mass-energy configurations that would result in a universe like ours [$10^{10(101)}$] to the number that would result in black hole dominated universes [$10^{10(123)}$]. The latter number is so much bigger than the former that when you divide the two numbers, you still end up with $10^{10(123)}$.[13] That means the initial entropy was fine-tuned to 1:$10^{10(123)}$. The staggering size of this number cannot be overstated. It literally defies comprehension. To give you a sense of how large this number is, consider the fact that there are only 10^{80} elementary particles in the observable universe. If we used each particle to represent each number in $10^{10(123)}$, it would require 10^{43} more universes the same size as ours just to write the number! That's 10 billion billion billion billion billion billion billion billion more universes!

Expansion rate

We also have to consider the expansion rate of the early universe. The density of mass and energy at the Big Bang determined, in part, the expansion rate of space. The density had to be precisely 1:10^{24} kilograms p/cubic meter one nanosecond (a billionth of a second) after the Big Bang for the expansion to be at the right rate. If the density were just 1 kilogram p/cubic meter smaller, galaxies would not have formed.[14] Stephen Hawing explained that "if the rate of expansion one second after the Big Bang had been smaller by even one part in a hundred thousand million million, the universe would have re-collapsed before it even reached its present size."[15] Hawking, then, asked a very pertinent question:

> Why is the universe so close to the dividing line between collapsing again and expanding indefinitely? In order to be as close as we are now, the rate of early expansion had to be chosen fantastically accurately. If the rate of expansion one second after the Big Bang had been less than one part in 10 to the 10th power, the universe would have collapsed after a few million years. If it had been greater by one part in 10 to the 10th power, the universe would have been essentially empty after a few million years. In neither case would it have lasted long enough for life to develop. Thus one either has to appeal to the anthropic principle or find some physical explanation of why the universe is the way it is.[16]

Quantum physicist, John Polkinghorne, says the expansion rate had to so precise in the early stages of the universe, and the margin of error so small, that it would be the equivalent of hitting a 1" target 20 billion light years away.

"The ripples [in the cosmic background radiation] shows that the explosion and expansion was precisely tweaked to cause just enough matter to congregate to allow galaxy formation, but not enough to cause the universe to collapse back on itself. Any slight variation one way or the other, and none of us would

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[13]Meyer, 148.

[14]Meyer, 151.

[15]Hawking, *A Brief History of Time*, 126.

[16]Stephen Hawking and Roger Penrose, *The Nature of Space and Time* (Princeton, NJ: Princeton University Press, 2015), 89.

be here to tell about it." The variations are so precise that George Smoot called them "machining marks from the creation of the universe" and the "fingerprints of the maker."[17]

Laws of Nature

Each of the following laws are required for a life-permitting universe: "(1) a universal attractive force, such as gravity; (2) a force relevantly similar to that of the strong nuclear force, which binds protons and neutrons together in the nucleus; (3) a force relevantly similar to that of the electromagnetic force; (4) Bohr's Quantization Rule or something similar; (5) the Pauli Exclusion Principle."[18]

Gravity is needed to hold the matter together in stars and planets. Electromagnetism is needed to hold electrons in their orbits. Without the strong nuclear force that binds neutrons and protons together in atoms, atoms larger than hydrogen could not form. Without the weak nuclear force, neutrons would not decay into protons.

Physical Constants

The physical constants represent the strength/values of each natural law. Let's explore a number of these constants, starting with the four fundamental forces.

Four Fundament Forces

Gravity

Gravity is an attractive force. It attracts objects to one another. It is the weakest of the four forces, with a strength of 1. What would happen if gravity had assumed a different value? If gravity were stronger, only elements heavier than carbon and oxygen would form.[19] If gravity were just 1/100,000,000,000,000th (1/100 trillionth) degree stronger, the universe would not have expanded to form terrestrial bodies. If we increased the strength of gravity a billion-fold, large life forms would be crushed. While a billion-fold may sound like a huge increase, this is just 1 part in 10 thousand billion, billion, billion of the highest value gravity could have assumed.[20]

If gravity were 1/100,000,000,000,000th degree weaker, the universe would expand at rate too fast for matter to coalesce into terrestrial bodies. Life would be impossible.[21] Stars wouldn't get hot enough to form carbon, or they wouldn't form enough elements needed for life. Furthermore, when the star died, it wouldn't explode and all those elements would remain in their core instead of being dispersed throughout the universe. Charles White writes, "If gravity were slightly stronger, all stars would be large, like the ones that produce iron and other heavier elements, but they would burn out too rapidly for the

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[17]Norman Geisler and Frank Turek, *I Don't Have Enough Faith to Be an Atheist* (Wheaton, IL: Crossway Books, 2004), 83.

[18]Collins, 211.

[19]Meyer, 138.

[20]Collins, 214.

[21]Logan Paul Gage, "Review: The Language of God: A Scientist Presents Evidence for Belief." Originally appearing in the American Spectator, it is available online from http://www.discovery.org/scripts/viewDB/index.php?command=view&id=3749&program=DI%20Main%20Page%20-%20Article&callingPage=discoMainPage; Internet; accessed 03 October 2006.

development of life. On the other hand, if gravity were weaker, the stars would endure, but none would be hot enough to produce the heavier elements necessary to form planets.[22]

Gravity is fine-tuned to 1 part in 10^{60} (1 trillion trillion trillion trillion trillion). That means the strength of gravity has to be specified out to 60 decimal places for life to exist. You can only adjust the strength of gravity by 1 part in 1,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 without prohibiting the existence of intelligent life. If the strength of gravity were 999,999,999,999, 999,999,999,999, 999,999,999,999, 999,999,999,999, 999,999,999,99**9** life would still be possible, but if it were 999,999,999,999, 999,999,999,999, 999,999,999,999, 999,999,999,999, 999,999,999,99**8** life would no longer be possible in the universe. To get a picture of just how precise gravity has to be, imagine a ruler stretching 14 billion light years across the observable universe (82 billion trillion miles). Each inch on that ruler represents a possible value for the force of gravity. Now imagine a pointer that could be moved along the ruler to indicate the actual value of gravity. That pointer would have to be set within a 1" space along that ruler for life to exist. If you moved the pointer 1" to the right or 1" to the left, life would be impossible.

In addition to being fine-tuned in itself, gravity is also fine-tuned relative to the other laws of nature. For example, the "fine-tuning of gravity [is] relative to the density of mass-energy in the early universe and other factors determining the expansion rate of the Big Bang – such as the value of the Hubble constant and the value of the cosmological constant. Holding these other parameters constant, if the strength of gravity were smaller or larger by an estimated one part in 10^{60} of its current value, the universe would have either exploded too quickly for galaxies and stars to form, or collapsed back on itself too quickly for life to evolve."[23]

Weak nuclear force

The weak nuclear force is 10^{34} times stronger than gravity. It holds neutrons together by controlling their rate of decay into protons. Charles White says that "if it were stronger, neutrons would decay more rapidly, and there would be nothing in the universe but hydrogen. However, if this force were weaker, all the hydrogen would turn into helium and other elements."[24] The weak nuclear force is fine-tuned to 1 part in 10^{100}, or 1000 billion billion billion billion billion billion billion billion billion.

Electromagnetism

Electromagnetism binds atoms together to form molecules. It is 1000 times stronger than the weak nuclear force. Charles White explains that "if it were either weaker or stronger, no chemical bonds would form, so no life could exist."[25]

Strong nuclear force

The strong nuclear force holds protons together in the nucleus of an atom. It is 100 times stronger than electromagnetism. It is fine-tuned to 1 part in 10,000 billion billion billion billion ($1:10^{28}$). If it were 1% stronger, nearly all carbon would be burned into oxygen. If it were 2% stronger, protons could not form

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[22]Charles Edward White, "God by the Numbers"; available from http://www.christianitytoday.com/ct/2006/003/26.44.html; Internet; accessed 13 March 2006.

[23]Collins, 215.

[24]White, "God by the Numbers."

[25]White, "God by the Numbers."

(and thus atoms could not form) and hydrogen would be extremely rare or non-existent.[26] That means no water. Since stars burn hydrogen, it would also mean no stars. Without stars, there is no carbon. Without carbon, there is no life. As Tim Folger explains: "Atomic nuclei are bound together by the so-called strong force. If that force were slightly more powerful, all the protons in the early universe would have paired off and there would be no hydrogen, which fuels long-lived stars. Water would not exist, nor would any known form of life."[27]

If the strong nuclear force were 5% weaker, deuteron (necessary for stellar nucleosynthesis) would unbind, which would leave the universe wholly composed of hydrogen.[28]

Other Constants

In addition to the four fundamental forces, there are many other constants. Here is a sampling:

- If the neutron's mass was increased by 1 part in 700, stars would cease to exist.
- The value of the gravitational constant is fine-tuned to $1:10^{35}$.[29]
- The mass of the up quark and down quark is fine-tuned to $1:10^{21}$.[30]
- The mass of the universe is fine-tuned to $1:10^{59}$.[31]

The cosmological constant deserves special attention. It enjoys the status of being the second most finely-tuned parameter following the initial entropy of the universe.

Einstein's field equations for general relativity implied the existence of a cosmological constant that – if it had a positive value – acted as a repulsive force causing the universe to expand, or – if it had a negative value – acted as an attractive force that would cause the universe to contract. If the vacuum of space contains negative energy (and we think it does), then it must act in a way consistent with the cosmological constant. If the energy density is not just right, then the universe would have expanded too fast or re-collapsed too fast for stars or galaxies to form.[32]

The cosmological constant measures the density of energy in space (repulsive force against gravity) that governs the expansion speed of space. Scientists estimate that it is fine-tuned to at least $1:10^{53}$ or $1:10^{90}$, but is typically thought to be as high as $1:10^{120}$. To illustrate just how precise this number is, your

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[26]William Lane Craig, "The Teleological Argument and the Anthropic Principle"; available from http://www.reasonablefaith.org/site/News2?page=NewsArticle&id=5179; Internet; accessed 20 May 2009. Craig draws from John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Clarendon Press, 1986) and John Leslie, "The Prerequisites of Life in Our Universe," in *Newton and the New Direction in Science*, ed. G.V. Coyne, M. Heller, J. Zycinski (Vatican: Citta del Vaticano, 1988).

[27]Tim Folger, "Science's Alternative to an Intelligent Creator: the Multiverse Theory" in Discover magazine; available from http://discovermagazine.com/2008/dec/10-sciences-alternative-to-an-intelligent-creator/article_view?b_start:int=2&-C=; Internet; accessed 11 November 2008.

[28]Craig, "The Teleological Argument and the Anthropic Principle."

[29]Casey Luskin, "Spider-Man, the Multiverse, and Intelligent Design"; available from https://evolutionnews.org/2022/01/spider-man-the-multiverse-and-intelligent-design/; Internet; accessed 12 January 2022.

[30]Meyer, 152.

[31]Rich Deem, "Evidence for the Fine Tuning of the Universe"; available from http://www.godandscience.org/apologetics/designun.html; Internet; accessed 30 July 2010. Deem's data is taken from Hugh Ross, *Big Bang Refined by Fire*, 1998.

[32]Collins, 215.

chances of finding a specific subatomic particle in our universe is $1:10^{80}$. Those chances are 10 billion times more likely than $1:10^{90}$ and 10,000 trillion trillion trillion times more likely than $1:10^{120}$.[33]

The amazing precision of the cosmological constant led Leonard Susskind (the Stanford physicist who invented string theory) to write, "[T]he discovery that the value of the cosmological constant – the energy of empty space which contributes to the expansion rate of the universe – seems absurdly improbable, and nothing in fundamental physics is able to explain why."[34] And again, "It's one of the greatest mysteries in physics. All we know is that if it were much bigger we wouldn't be here to ask about it."[35] University of Texas physicist and Nobel laureate, Steven Weinberg, agrees: "This is the one fine-tuning that seems to be extreme, far beyond what you could imagine just having to accept as a mere accident."[36]

Ratios between Constants

Not only must each physical constant be individually fine-tuned for the universe to be life-permitting, but each constant must be fine-tuned in relation to the other constants. In other words, there are layers of fine-tuning. Here are some examples:

- The ratio of the masses of neutrons to protons is fine-tuned to 1:1,000[37]
- The ratio of the weak nuclear force to the strong nuclear force is fine-tuned to 1:10,000[38]
- The ratio of electromagnetic force to gravity fine-tuned to $1:10^{40}$.[39]
- The ratio of electrons to protons is fine-tuned to $1:10^{37}$.[40]

Hugh Ross provides a wonderful illustration to elucidate the level of precision exemplified by 1 in 10^{37}. Imagine that you covered the entire North American continent in dimes all the way up to the moon (a height of ~239,000 miles). Then, you did the same thing on a billion other continents the same size as North America. Paint one dime red and mix it into one of the piles. Blindfold a friend and ask him to pick out the red dime on the first try. The odds that he will pick the red dime are $1:10^{37}$.[41]

Our Solar System

The right laws of nature, the right initial conditions, and the right physical constants are all necessary for intelligent life, but not sufficient. If they were sufficient, the universe should be teeming with life. To our knowledge, however, the only life that exists in the universe exists on our planet. A fourth level of fine-

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[33]Meyer, 152.

[34]Leonard Susskind, in an interview with Amanda Gefter of *New Scientist*, "Is String Theory in Trouble?", December 17 2005 edition, p. 48; available from http://www.newscientist.com/channel/fundamentals/mg18825305.800.html; Internet; accessed 5 January 2006.

[35]Tim Folger, "Science's Alternative to an Intelligent Creator: the Multiverse Theory" in Discover magazine; available from http://discovermagazine.com/2008/dec/10-sciences-alternative-to-an-intelligent-creator/article_view?b_start:int=1&-C=; Internet; accessed 11 November 2008.

[36]Folger, "Science's Alternative to an Intelligent Creator: the Multiverse Theory."

[37]Luskin, "Spider-Man, the Multiverse, and Intelligent Design."

[38]Luskin, "Spider-Man, the Multiverse, and Intelligent Design."

[39]Meyer, 142.

[40]Deem, "Evidence for the Fine Tuning of the Universe."

[41]Hugh Ross, *The Creator and the Cosmos: How the Greatest Scientific Discoveries of the Century Reveal God* (Colorado Springs, CO: NavPress, 1995), 115.

tuning is required for life, namely the fine-tuning of the local solar system. Our planet and solar system are fine-tuned for life in a host of ways. Here are just some of the ways it is fine-tuned.

The Sun

- If the sun were too young, it would contain too many heavy elements for life to exist. If it were too old, it would contain too few heavy elements.[42]
- If the sun were more massive, its luminosity would be erratic and it would burn up too quickly for life to exist. If it were less massive, the Earth would rotate too slowly and there wouldn't be enough UV radiation for photosynthesis.[43]
- Solar luminosity must be precise, delicately balanced between a runaway greenhouse (Venus) and a runaway freeze-up (Mars).

Jupiter

If Jupiter were closer to Earth, its gravitational pull would destabilize our orbit. If Jupiter were further away, it would not be able to protect Earth from asteroids and comets.[44] The same problems would arise if Jupiter's mass was larger or smaller.

Earth

- If the Earth were closer to the sun, it would be too warm for a stable water cycle. If it were further from the sun, it would be too cold.[45]
- If the Earth's axis were tilted more or less, the surface temperature differences would be too great to sustain life.[46]
- If Earth's rotation were slower, the nights and days would be too long, creating temperature extremes. If the rotation speed were faster, the wind storms would be extreme (e.g. 1000 mph on Jupiter).
- If our magnetic field were stronger, electromagnetic storms would be too severe for life. If it were weaker, we would not be protected well enough from solar and stellar radiation.[47]
- If our crust were thicker, it would take too much oxygen from our atmosphere. If our crust were thinner, volcanic and tectonic activity would be too much for life.[48]
- If Earth's surface gravity were stronger, the atmosphere would retain too much ammonia and methane. If it were weaker, Earth would lose too much water.[49]
- If carbon-dioxide levels were higher, a runaway greenhouse effect would result. If they were lower, photosynthesis would be affected.[50]

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[42]Deem, "Evidence for the Fine Tuning of the Universe"; available from http://www.godandscience.org/apologetics/designun.html; Internet; accessed 30 July 2010. Deem's data is taken from Hugh Ross, *Big Bang Refined by Fire*, 1998. See also http://crev.info/2012/01/tilt-a-world-another-constraint-on-habitability/ for more information on how specific the tilt of the planet must be.

[43]Ibid.

[44]Ibid.

[45]Ibid.

[46]Ibid.

[47]Ibid.

[48]Ibid.

[49]Ibid.

[50]Ibid.

The Moon

- If the moon were 2% more massive (7 mile longer radius), it would destabilize our axis.
- If the moon were 2% less massive, it could not put a brake on our rotation rate. Eventually Earth would rotate every few hours, wreaking havoc on our weather and making advanced life impossible.

Frederic A. Rasio, a theoretical astrophysicist and professor of physics and astronomy in Northwestern's Weinberg College of Arts and Sciences says, "We also know that the solar system is special and understand at some level what makes it special. … The solar system had to be born under just the right conditions to become this quiet place we see. The vast majority of other planetary systems didn't have these special properties at birth and became something very different."[51]

EXPLAINING THE FINE-TUNING

How can all of this fine-tuning be explained? Of all the ways our universe could have been, why is it that the basic features of the universe – both individually and collectively – fall within an excessively improbable range that makes intelligent life possible? It can only be explained in one of three ways: (1) physical necessity; (2) chance; (3) intelligence. A teleological argument holds that the fine-tuning is best explained by a designing intelligence, and the identify of this designer is none other than the God of theism.[52] Here is what the argument looks like in deductive form:

P1 Fine-tuning is either explained by physical necessity, chance, or design
P2 Fine-tuning cannot be explained by chance or physical necessity

C The fine-tuning is due to design

A logical analysis leads to the further conclusion that the designer is a theistic God.

Physical Necessity?

Graham Oppy thinks that "absent reason to think that alleged fine-tuning is a result of the outplaying of objective chance – we have no good reason at all to suppose that the allegedly fine-tuned features of the visible universe absolutely (metaphysically) could have been different from the way that they actually are."[53] In other words, the constants assume the values they do because they have to. It is physically necessary that they have those values. No other values are physically possible.

This does not seem right. The laws of nature themselves cannot determine the value of their own constants, so how could it be due to physical necessity? Our modal intuitions also count against this theory. If the fine-tuning is due to physical necessity, that would mean that the universe had to be

[51]Referring to Frederic A. Rasio, Edward W. Thommes, and Soko Matsumura, "Gas Disks to Gas Giants: Simulating the Birth of Planetary Systems," *Science*, August 8, 2008, as found at Science Daily, "Solar System Is Pretty Special, According To New Computer Simulation"; available from http://www.sciencedaily.com/releases/2008/08/080807144236.htm; Internet; accessed 18 August 2008.

[52]"Teleology" comes from the Greek word *telos*, referring to the goal, aim, or purpose of something. Teleological arguments argue for the existence of God based on various evidences of design in the natural world.

[53]Graham Oppy, "The Shape of Causal Reality: A Naturalistic Adaptation of O'Connor's Cosmological Argument," *Philosophia Christi*, Vol. 12, Number 2 (2010): 287.

exactly the way it is. No other kind of universe was possible. But this seems absurd. It would mean there is only one possible world: the actual world. And yet we can imagine all sorts of different kinds of universes existing with different physical laws, different values for the constants, or constituted by different particles. In fact, that is how scientists are able to determine what the universe would be like if the values of the constants were different, or if the initial conditions of the universe were different.

If fine-tuning is explained by physical necessity, it would mean the laws of nature are metaphysically necessary. It would also mean that the fundamental particles of our universe (quarks, leptons, bosons) are also necessary – not just in kind, but in number and arrangement as well. Why are there *x* number of particles in the universe rather than *x* + 1 or *x* – 1? The answer is that it just has to be *x*. It can't be anything other than *x.* But this seems preposterous. Surely the number or kind of fundamental particles could have been different, or arranged differently, or operated according to different physical laws.

Another reason to think the constants are not physically necessary is that there is nothing to determine their values. The nature of a thing that comes into being can only be determined by the thing that brings it into being. If the universe sprang into existence from absolutely nothing, then there were no physical or metaphysical entities to determine what came into existence. If we start with nothing, then it is just as probable that a universe with our precise physical constants pops into existence as it is that a universe with different physical constants pops into existence! If something could pop into existence from nothing, then anything and everything could pop into existence from nothing, including constants with different values. There is no basis for thinking that the physical constants of our universe are physically necessary.

What about string theory? String theory purports to explain why the constants assume the values they do, but that's only because string theory leads to the possibility of 10^{500} different universes. At best, it can only show that we should not be surprised that one of these universes is fine-tuned for life.[54] String theory, however, has not and cannot predict that the actual universe had to have the constants it does. It does not demonstrate that our universe is physically necessary.

Chance?

Could the values of the physical constants be explained by chance? No. Some of these physical constants were initial conditions present at the origin of the universe, so they cannot be explained on the basis of some random, chance, evolutionary process. They were baked in from the get-go. Besides, it seems preposterous to think that the constants could assume their values by sheer chance given the incomprehensible precision involved. As Max Tegmark writes:

> Our universe appears surprisingly fine-tuned for life in the sense that if you tweaked many of our constants of nature by just a tiny amount, life as we know it would be impossible. … Some of the fine-tuning appears extreme enough to be quite embarrassing—for example, we need to tune the dark energy to about 123 decimal places to make habitable galaxies. To me, an unexplained coincidence can be a tell-tale sign of a gap in our scientific understanding. Dismissing it by saying "We just got lucky—now stop

[54]William Lane Craig, *Reasonable Faith: Christian Truth and Apologetics*, 3rd edition (Wheaton: Crossway, 2008), 162-3.

> looking for an explanation!" is not only unsatisfactory, but is also tantamount to ignoring a potentially crucial clue.[55]

It is beyond the productive capacity of chance to produce such precision. If our alphabet cereal spelled "eat this and you will die," we would assume that a family member must have arranged the letters because we know this is beyond the productive capacity of chance. How much more, then, should we conclude that chance is incapable of accounting for the fine-tuning which is orders upon orders of magnitude more specified than the message in our cereal?

Design?

Our uniform experience tells us that only intelligent agents are capable of setting multiple parameters at extremely precise measurements to fulfill a particular purpose. We recognize the presence of design when some *x* (1) has a low probability of occurring by chance and (2) it matches an independent pattern. For example, imagine you observed someone handing a phone to a random stranger and asking them to randomly dial any 10-digit phone number. The person does so, and immediately your phone rings. They called you! Would you conclude that this happened by chance? After all, one string of 10-digits is just as improbable as the next. Of course you wouldn't conclude that it was chance! You would immediately conclude that the "stranger" was not randomly chosen, but was selectively chosen by the man with the phone and that the "stranger" was given your phone number in advance (an independent pattern). In other words, you would recognize that this event was designed.

Of course, when it comes to any event, the probability of that event occurring is based on the number of attempts one has (probabilistic resources). If the odds of winning a game are 1 in 100, and it is played only once, the odds of winning are just 1:100. But if you play the game 200 times, odds are that you will win the game twice. Given enough chances, certain improbable events are bound to happen. So to calculate the probability of some *x* occuring, we have to consider the number of opportunities available to obtain *x*.

William Dembski has calculated what he calls the "universal probability bound" (UPB). This number represents the total number of events that will ever occur in the history of the universe (both past and future). If the chance of an event occurring is less than the UPB, we can safely conclude that it was the result of design rather than chance. How is the UPB calculated? If we start with the number of seconds the universe will exist prior to its heat death (10^{16}) and add the number of elementary particles in the universe (10^{80}) as well as the number of alterations in quantum states per second (10^{43}), we discover that there will "only" be 10^{139} events in the whole history of the universe. Written out, that's 10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000, 000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000. However, 10^{139} events does not provide enough probabilistic resources to ensure that chance events of the magnitude we are talking about could ever happen.[56] It follows, then, that they must have been designed.

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[55]Max Tegmark, "The Multiverse Strikes Back," *Scientific American*, posted 19 July 2011; available from http://www.scientificamerican.com/article.cfm?id=multiverse-the-case-for-parallel-universe; Internet; accessed 08 November 2011.

[56]The ICPC fine-tuning has been present from the beginning of the universe. The ICPC fine-tuning could not have been produced by trial and error over time. There was only one chance of getting it right.

A good number of notable scientists who are keenly aware of the fine-tuning problem have noted their openness to the design hypothesis as the best explanation. For example, self-styled skeptic, Massimo Pigliucci, writes: "[F]alsification of the materialist paradigm is indeed possible. The recent controversy over the so-called anthropic principle is a case in point. Should we conclusively determine that the probability of existence of our universe is infinitesimally small, and should we fail to explain why physical constants have assumed the quantities that we observe, the possibility of a designed universe would have to be considered seriously."[57]

Fred Hoyle was so shaken by fine-tuning that he confessed, "A commonsense interpretation of the facts suggests that a super intellect has monkeyed with the physics, as well as chemistry and biology, and that there are no blind forces worth speaking about in nature. The numbers one calculates from the facts seem to me so overwhelming as to put this conclusion almost beyond question."[58]

British astrophysicist, Paul Davies, declared that "there is for me powerful evidence that there is something going on behind it all.... It seems as though somebody has fine-tuned nature's numbers to make the Universe.... The impression of design is overwhelming."[59] And again, "The laws [of physics]…seem themselves to be the product of exceedingly ingenious design."[60]

And finally, Arno Penzias affirms that "astronomy leads us to a unique event, a universe which was created out of nothing and delicately balanced to provide exactly the conditions required to support life. In the absence of an absurdly-improbable accident, the observations of modern science seem to suggest an underlying, one might say, supernatural plan."[61]

IDENTIFYING THE DESIGNER

The conclusion that the fine-tuning is best explained by a designing intelligence is extremely informative, but it still leaves one wondering regarding the identity of the designer.[62] Who, or what, designed the

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[57]Massimo Pigliucci, "The Provine-Scott Discussion at the RET: Methodological vs. Philosophical Naturalism," available from www.rationalists.org/rc/1998_spring/provine-scott.htm; Internet; accessed 26 February 2008.

[58]Fred Hoyle, "The Universe: Past and Present Reflections," *Engineering and Science* (November 1981): 12, quoted in Norman Geisler and Frank Turek, *I Don't Have Enough Faith to Be an Atheist* (Wheaton, IL: Crossway Books, 2004), 106-7.

[59]Paul Davies, *The Cosmic Blueprint: New Discoveries in Nature's Creative Ability To Order the Universe* (New York: Simon & Schuster, 1988), 203. Davies is no theist. He is a pantheist who sees God as the guiding rules of the universe.

[60]Paul Davies, *Superforce* (New York, Simon & Schuster, 1985), 243.

[61]Quoted in Walter Bradley, "The 'Just-so' Universe: The Fine-tuning of Constants and Conditions in the Cosmos," in William Dembski and James Kushiner, eds., *Sings of Intelligence* (Grand Rapids, MI: Baker, 2001), 168, quoted in Norman Geisler and Frank Turek, *I Don't Have Enough Faith to Be an Atheist* (Wheaton, IL: Crossway Books, 2004), 106.

[62]Some have faulted design arguments because they don't necessarily prove that God exists, or that this God is the God of Christianity. But this is not their aim. Design arguments only aim to demonstrate that the universe requires a transcendent designing intelligence. No single argument can prove everything that needs to be proven. Each theistic argument provides us with a partial picture, that when combined, portrays a more complete picture that best resembles the God of theism:

- The Kalam cosmological argument gives you a personal, immaterial, non-spatial, eternal, intelligent, powerful, personal Creator.
- The contingency argument gives you a necessary being.
- The moral argument gives you a morally good being.
- The teleological argument gives you a transcendent, intelligent designer of the universe.
- The ontological argument gives you a perfect being with maximal greatness.

Of course, as I will argue, we can make significant headway on identifying the designer by way of logical analysis. Combined with other arguments, it does point to the God of Christianity.

universe? Through a logical analysis, I think we can make great advancements toward answering this question.

The Designer Must be a Personal Agent

We can safely rule out the idea that the designer is some sort of mathematical law, force, or abstract object. Design requires purpose, forethought, and intelligence. These features belong uniquely to minds, and minds belong uniquely to personal agents. The designer is a *who*, not a *what*.

What kind of personal agent could design the universe? I can only think of three possibilities: (1) an alien or alien race of some sort; (2) a finite god or group of finite gods; (3) a theistic being such as the one represented in Judaism, Christianity, and Islam.

Aliens Don't Make the Cut

Could the designer be an alien or group of aliens? No. As physical beings, aliens would have originated within the physical universe at some point in the finite past. They could only come into being within a universe that was already finely-tuned for intelligent life. If the fine-tuning of the universe had to be in place prior to the origin of aliens, then aliens cannot be the cause of the fine-tuning.

This is particularly evident for the fine-tuning of the initial conditions of the universe. Since the fine-tuning was in place from the moment physical reality began to exist, the designer existed before the universe. As such, he/they is both transcendent and immaterial. Aliens are neither, and thus aliens could not be responsible for the fine-tuning.

Finite gods or Infinite God?

If the designer must be immaterial and transcend the universe, that leaves us with some sort of divine or spiritual being. Is that being finite or infinite? Is he/they akin to the polytheistic gods of Hinduism and Greece, or the infinite perfect being of theism?

Not a Finite god

If the designer were a finite divine being without the perfections of the theistic God, then he/they would be a contingent being.[63] Contingent beings require external causes, so there would have to be a second god who explains the existence of the creator god. This would invite an infinite regress because the second finite god would need an explanation in a third finite god, and the third finite god would require an explanation in a fourth finite god, *ad infinitum*. An infinite regress is impossible, therefore, the

[63]"Being" often connotes consciousness in modern parlance. That's not what philosophers have in mind when they speak of contingent beings. The term could just as easily be expressed as "contingent thing."

designer cannot be finite.[64] He must be a metaphysically necessary being who requires no causal explanation.[65] This is the kind of divine being exemplified in Judaism, Christianity, and Islam.

And Then There Was One

Could we narrow down the identity of the designer even more? Is it possible to determine whether the theistic being who designed our universe is the God of Judaism, Christianity, or Islam? Some may take this to be a meaningless question because it is assumed that all three religions have the same conception of God. This is not true for two reasons. First, mainstream Christianity views God as a Trinity of persons whereas Muslims and Jews hold to strict monotheism. That is a monumental conceptual difference. Second, each religion describes God's attributes, character, and activity differently.

Given the differences in each religion's conception of God, which one truly represents Him? A full case for one religion over the others would require a separate research paper. For our purposes here, let me offer just one piece of evidence that I think forecloses on Christianity as being the religion that best represents the character and nature of the theistic God: the resurrection of Jesus.

Jesus taught many things concerning God's identity and will. Some considered His teachings to be blasphemous, and executed Jesus on that basis. If Jesus was teaching false things about God, then Jesus deserved his fate. However, God raised Jesus from the dead. In doing so, God vindicated Jesus' teachings and claims. That means we can trust that Jesus' religious perspective was correct. Since Jesus' teachings differed from both Judaism and Islam, those religions cannot represent the most accurate view of God. Christianity alone tells us what the designer God is like.

The million dollar question, of course, is why we should believe Jesus rose from the dead. Answering that question is beyond the scope of this paper, but I have detailed the evidence elsewhere and refer you to those resources for more information.[66]

CONCLUSION

The universe is finely-tuned for the existence of intelligent life. We observe hundreds of examples of fine-tuning at multiple levels. Many of these finely-tuned parameters have to be so precise that it defies human comprehension. The fine-tuning cannot be explained by chance or physical necessity, but only by design. Only intelligent agents are capable of setting multiple parameters at extremely precise

[64]It is logically and metaphysically possible that our universe was designed by a finite divine/spiritual being who was himself created by the metaphysically necessary God of theism. It's also possible that our universe was created by a finite divine/spiritual being who was himself created by another finite divine/spiritual being, who was himself created by the metaphysically necessary God of theism, and so on. So in saying that the designer of our universe cannot be finite, I don't mean to imply that it is metaphysically or logically impossible that our universe was created by a finite god. It is possible, but given the principle of parsimony (Occam's Razor), there is no need to multiply causal entities beyond necessity. There is no reason to invoke a finite god to explain the design of our universe when the metaphysically necessary being is adequate to the task. Whether the metaphysically necessary God of theism created our universe immediately or mediately through finite intermediaries, the fact remains that the God of theism is ultimately responsible for the design of our universe. Since we have reason to believe a metaphysically necessary God exists and no independent reason to believe a finite god exists, there is no reason to believe the designer of our universe was a finite god.

[65]This trades on the contingency argument for God's existence. For a brief introduction, see https://thinkingtobelieve.com/2012/06/21/even-if-the-universe-is-eternal-it-still-needs-a-cause/ and https://thinkingtobelieve.com/2013/04/23/contingency-argument-for-gods-existence/.

[66]For a short case, see https://thinkingtobelieve.com/2019/04/21/the-historical-evidence-for-the-resurrection-of-jesus-a-short-case-2/. For a fuller treatment, see http://onenesspentecostal.com/resurrection.htm.

measurements to accomplish a purpose. The reason it feels like the universe knew we were coming is because it did. God designed the universe in such a way that it could host intelligent life. The fine-tuning of the universe, then, provides a powerful argument for the existence of God.

TIPS AND TACTICS FOR PRESENTING THE FINE-TUNING ARGUMENT

It's one thing to know the ins-and-outs of the fine-tuning argument, but it's an entirely different matter to be able to communicate the argument in a way that people can quickly and easily grasp. Here are some tips and tactics for presenting the argument to others.

First, emphasize that there is a scientific consensus concerning the reality of fine-tuning. What's debated is the explanation. People tend to accept as true whatever the consensus of scientists say is true, but are skeptical of fringe science and religious claims. You can avoid a lot of initial skepticism about the *fact* of fine-tuning by appealing to the scientific consensus.

Second, don't bog people down with too many examples of fine-tuning. Just a few examples are usually sufficient to make the point. Personally, I like to choose one example from each level of fine-tuning: one from the initial conditions of the universe, one from the physical constants, and one from our solar system. This allows you to demonstrate the breadth of fine-tuning without having to list a bunch of examples.

Third, try to avoid numbers and math. Use analogies instead, or at least use analogies as a supplement to the numbers. Most people don't understand exponents or "magnitudes of order." So when you say the cosmological constant is fine-tuned to 1 part in 101^{120}, that may be interpreted as a small number. It helps to translate that number into billions or trillions, but it is even more helpful to give an analogy. To describe the precision of the cosmological constant, for example, ask them to imagine having to find a specific subatomic particle in our universe while blindfolded. It would be virtually impossible. And yet, the chances of them being able to do so are 10,000 trillion trillion trillion times better than the chances of the cosmological constant having its precise value.

Fourth, appeal to their design intuitions. Ask them how we can know when something is designed. For example, how do we know the images on Mount Rushmore are designed rather than the products of chance? We recognize design when two conditions are present: (1) something is very complex or highly unlikely, and (2) it conforms to an independent pattern. We recognize the images on Mt. Rushmore are designed because the patterns are complex and unlikely, and those patterns conform to images of past American presidents. In the same way we can recognize Mount Rushmore was designed, we can recognize the universe was designed. The values of the physical constants are highly unlikely and conform to the pattern required for intelligent life.

Fifth, argue from the lesser to the greater. Consider the telephone analogy I provided earlier. In the same way you would not think the stranger dialed your phone number on the first try by chance, you should not think the fine-tuning can be explained by chance given the fact that getting the universe's numbers just right on the first try are many orders of magnitude less likely than getting your phone number right on the first try. What is true of the lesser (phone) is also true of the greater (universe): it is best explained by design.

Sixth, be prepared to give a concise summary of the fine-tuning argument so people don't get lost in the details. You might say, "Our universe exhibits a level of specificity and complexity that cannot be explained by chance or physical necessity, but only by a designing intelligence who transcends the universe and intentionally designed the universe to be inhabited by advanced life forms such as ourselves." If that sounds a bit too stuffy, try this: "There are so many features of our universe that have to be just right for intelligent life to exist. The level of precision involved defies human comprehension. It can't be explained by pure chance and there's no reason to think the universe had to be this way, so the best explanation is that it was designed. And if it was designed, it requires a designer: God."

OBJECTIONS

Not everyone is convinced that design is the best explanation for fine-tuning. A number of objections have been raised by scientists and philosophers alike. Here is a sampling of the most common objections.

Objection #1: *If the universe were not fine-tuned for life, we would not be here to observe the universe and wonder at its precision. We can only contemplate the existence of an unlikely, life-bearing universe in a universe fine-tuned for life. If the universe had to be the way it is for us to wonder at it, we should not be shocked that the universe is finely-tuned for our existence.*

Response #1: This objection is an invocation of the anthropic principle. The anthropic principle holds that "if observers observe anything, they will observe conditions that permit the existence of observers."[67] Put another way, only universes fine-tuned for the existence of observers will contain observers to observe the fact that their universe is finely-tuned for the existence of observers. While this objection has an intuitive force behind it, it suffers from a number of problems.

First, it is a tautology, or truism. The objection boils down to observers can only observe where it's possible for observers to observe. Tell me something I did not know! That is why the objection, while true, is uninteresting.

Second, it confuses observation with explanation. It ignores the *why* question. Why is our universe fine-tuned such that we can observe it? Ducking that question with a truism about observers only being possible in environments where they are possible is tantamount to me trying to argue that God must have created humans because if He hadn't, we would not be here to make such a claim.[68]

Quasars are extremely bright active galactic nuclei, powered by supermassive black holes. Their extreme luminosity allows us to see them from great distances. When quasars were first discovered, their brightness had to be explained. It would not do to say that they must be that bright, otherwise we would not see them to even wonder why they are so bright. Their brightness may be *how* we know they exist, but that does not tell us *why* they are as bright as they are. Similarly, the anthropic principle can explain why we do not observe a life-prohibiting universe (it is impossible), but it does nothing to explain why the universe is fine-tuned to permit the existence of intelligent life.[69]

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[67]Barnes, "The Fine-Tuning of the Universe for Intelligent Life," 21 December 2011; available from http://arxiv.org/abs/1112.4647; Internet; accessed 16 April 2012; page 4.

[68]Alvin Plantinga, "Review of Richard Dawkins' *The God Delusion*," available online.

[69]Barnes, 4.

Third, defenders of the anthropic principle confuse two claims. They confuse the true claim that "If observers who have evolved within a universe observe its constants and quantities, it is highly probable that they will observe them to be fine-tuned for their existence" with the false claim that "it is highly probable that a universe exist which is finely tuned for the evolution of observers within it."[70] As William Lane Craig observes, "It's true that we shouldn't be surprised that we don't observe that we are not alive, since if we were not alive, we couldn't be surprised about it. But it doesn't follow that therefore we shouldn't be surprised that we do observe that we are alive, given the unfathomable improbability of the fine-tuning requisite for our existence."[71] Of all the ways our universe could have been, why is it that the basic features of the universe – both individually and collectively – fall within an excessively improbable range that makes intelligent life possible? We should be surprised by this.

Dennis Alexander exposes how weak the anthropic objection is with an analogy. Imagine an accountant was kidnapped. His kidnappers told him that he must win the national lottery 10 consecutive weeks in a row or he will be killed (1:10^{60} odds). The accountant, does, in fact win the lottery 10 consecutive weeks in a row. However, he is not surprised at this, reasoning that if this extremely unlikely series of events had not occurred, he would not be alive to wonder at it.[72]

William Lane Craig provides another poignant analogy, borrowed from philosopher John Leslie:

> Suppose you are dragged before a firing squad of 100 trained marksmen, all of them with rifles aimed at your heart, to be executed. The command is given; you hear the deafening sound of the guns. And you observe that you are still alive, that all of the 100 marksmen missed! Now while it is true that
> 5. You should not be surprised that you do not observe that you are dead,
> nonetheless it is equally true that
> 6. You should be surprised that you do observe that you are alive.
> Since the firing squad's missing you altogether is extremely improbable, the surprise expressed in (6) is wholly appropriate, though you are not surprised that you do not observe that you are dead, since if you were dead you could not observe it. Similarly, while we should not be surprised that we do not observe features of the universe which are incompatible with our existence, it is nevertheless true that
> 7. We should be surprised that we do observe features of the universe which are compatible with our existence, in view of the enormous improbability that the universe should possess such features.[73]

Objection #2: *The multiverse can explain the fine-tuning.*

Response #2: Many scientists have come to adopt multiverse theories to explain the fine-tuning of our universe. There are several multiverse theories, but the common idea behind them all is that our universe is not the only universe that exists. There is a near infinite number of universes, each with their own unique values for the physical constants and initial conditions. Given the multitude of universes – it is reasoned – there is bound to be at least one that is life-permitting. It's like cards. The chances of randomly drawing a royal flush in spades is one in 2.5 million. If you only drew one hand, the chances of getting a royal flush are vanishingly small. However, if you drew 10 million hands, chances are you would get a royal flush four times. The same is true of the multiverse. The more universes you have, the more likely you'll stumble on one that is life-permitting. The multiverse, then, makes a life-permitting

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[70]Craig, *Reasonable Faith: Christian Truth and Apologetics*, 165.

[71]William Lane Craig, "Knowing You are Dead"; available from http://www.reasonablefaith.org/knowing-that-you-are-dead; Internet; accessed 21 March 2012.

[72]Dennis Alexander, *Rebuilding the Matrix* (Oxford: Lion, 2001), 421, as found in Peter S. Williams, "The Design Inference from Specified Complexity by Scholars Outside the Intelligent Design Movement", *Philosophia Christi*, ed. Craig Hazen, Vol. 9.2.07, p 424.

[73]Craig, "The Teleological Argument and the Anthropic Principle.

universe inevitable rather than improbable. As David Berlinski writes, "[B]y multiplying universes, the Landscape dissolves improbabilities. To the question *What are the odds?* the Landscape provides the invigorating answer that it hardly matters."[74]

Stephen Hawking admits that our universe is fine-tuned for intelligent life, but thinks this problem can be solved by a multiverse:

> Our universe and its laws appear to have a design that both is tailor-made to support us and, if we are to exist, leaves little room for alteration. That is not easily explained and raises the natural question of why it is that way… The discovery relatively recently of the extreme fine-tuning of so many of the laws of nature could lead at least some of us back to the old idea that this grand design is the work of some grand designer…. That is not the answer of modern science…our universe seems to be one of many, each with different laws.[75]

Many scientists see the multiverse as the only scientific solution to the fine-tuning problem. Bernard Carr, cosmologist at Queen Mary University of London, writes: "If there is only one universe you might have to have a fine-tuner. If you don't want God, you'd better have a multiverse." Leonard Susskind also recognizes that scientists only have two choices to explain the fine-tuning: accept the multiverse or embrace an intelligent designer. He writes, "The stakes are to accept the [string] landscape and the dilution in the scientific method it implies or give up science altogether and accept intelligent design (ID) as the explanation for the choices of parameters of the standard model."[76]

So what is driving the multiverse theory? Is it the empirical evidence, or the desire to escape the conclusion that our universe was designed?[77] I would argue that a philosophical bias in favor of naturalism and against theism explains the current popularity of multiverse theories. People would rather believe in an infinite number of invisible universes than in one invisible God! Here are just some of the many problems with multiverse theories.

<u>Cannot be Tested</u>

Other universes, even if they existed, cannot be observed. Many scientists agree that this makes it nearly impossible to empirically test multiverse theories. As George Ellis observed:

> A remarkable fact about our universe is that physical constants have just the right values needed to allow for complex structures, including living things. Steven Weinberg, Martin Rees, Leonard Susskind and others contend that an exotic multiverse provides a tidy explanation for this apparent coincidence: if all possible values occur in a large enough collection of universes, then viable ones for life will surely be found somewhere. This reasoning has been applied, in particular, to explanation the density of the dark energy that is speeding up the expansion of the universe today. I agree that the multiverse is a possible

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[74]David Berlinski, *The Devil's Delusion: Atheism and Its Scientific Pretensions* (New York: Crown Forum, 2008), 124.

[75]Stephen Hawking, "Science. Life. The Planet," *The Times, Eureka*, Issue 12, September 2010, p.24.

[76]Lee Smolin. *The Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next.* (New York: Houghton Mifflin Co., 2006), 197.

[77]There is a big scientific debate over multiverse theories. Some argue that the multiverse is not a scientific theory because it does not make predictions and is not falsifiable. Others argue that the multiverse is a scientific theory because it flows from the implications of other scientific theories such as inflation and string theory. While it is true that multiverse theories are extrapolated from other scientific theories rather than being invented out of whole cloth for the purpose of explaining fine-tuning, I would argue that the recent popularity and defense of multiverse theories in the scientific community is being driven more by a desire to explain away the fine-tuning than by the scientific merits of the theory.

> valid explanation for the value of this density; arguably, it is the only scientifically based option we have right now. But we have no hope of testing it observationally.[78]

One of the hallmarks of scientific theories is their testability. Something that is not testable is not falsifiable. A non-falsifiable theory is an unscientific theory. That's why science writer John Horgan concludes that "multiverse theories aren't theories – they're science fictions, theologies, works of the imagination unconstrained by evidence."[79] Cosmologists like George Ellis, Peter Woit, and many others agree. Physicist, Paul Davies, opines that "one may find it easier to believe in an infinite array of universes than in an infinite Deity, but such a belief must rest on faith rather than observation."[80]

Multiverse Theories are based on Untested Theories

Multiverse theories are based on inflationary theory and/or string theory. Neither theory has been empirically verified, which means multiverse theory is resting on a very shaky foundation. As George Ellis observes:

> All in all, the case for the multiverse is inconclusive. The basic reason is the extreme flexibility of the proposal: it is more a concept than well-defined theory. Most proposals involve a patchwork of different ideas rather than a coherent whole. The basic mechanism for eternal inflation does not itself cause physics to be different in each domain in a multiverse; for that, it needs to be coupled to another speculative theory. Although they can be fitted together, there is nothing inevitable about it. … Nothing is wrong with scientifically based philosophical speculation, which is what multiverse proposals are. But we should name it for what it is.[81]

Regarding string theory, Michio Kaku writes in his textbook on superstring theory that "not a shred of experimental evidence has been found to confirm…superstrings."[82] George Ellis says "string theory has moved from being a theory that explains everything to a theory where almost anything is possible. … But string theory is not a tried-and-tested theory; it is not even a complete theory. If we had proof that string theory is correct, its theoretical predication could be a legitimate, experimentally based argument for a multiverse. We do not have such proof."[83]

Regarding inflationary theory, Ijjas, Steinhardt, and Loeb write:

> The Planck satellite results—a combination of an unexpectedly small (few percent) deviation from perfect scale invariance in the pattern of hot and colds spots in the CMB and the failure to detect cosmic gravitational waves—are stunning. For the first time in more than 30 years, the simplest inflationary models, including those described in standard textbooks, are strongly disfavored by observations. … Still, there is a hitch: inflationary cosmology, as we currently understand it, cannot be evaluated using the scientific method. As we have discussed, the expected outcome of inflation can easily change if we vary the initial conditions, change the shape of the inflationary energy density curve, or simply note that it

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[78]George F. R. Ellis, "Does the Multiverse Really Exist?", *Scientific American*, August 2011, 38-43, 42.

[79]John Horgan, "The Scientific Curmudgeon – Is theorizing about parallel universes immoral?", quoted in "Horgan on Greene Book"; available from http://darwiniana.com/2011/02/12/horgan-on-greene-book/; Internet; accessed 12 January 2014.

[80]Quoted in Fred Hareen, *Show Me God*, vol. 1 (Wheeling, IL: Daystar, 2000), 239, and again in Norman Geisler and Frank Turek, *I Don't Have Enough Faith to Be an Atheist* (Wheaton, IL: Crossway Books, 2004), 111.

[81]Ellis, 38-43, 43.

[82]Michio Kaku, *Introduction to Superstrings and M-Theory*, 2nd edition (New York: Springer-Verlag, 1999), 17.

[83]Ellis, 38-43, 42.

> leads to eternal inflation and a multimess. Individually and collectively, these features make inflation so flexible that no experiment can ever disprove it."[84]

Assumes the wrong geometry of universe

Multiverse theory requires the universe to have what is called an "open geometry," but the evidence points to a flat universe instead. Jeff Zweerink explains this point in more detail:

> One currently testable aspect of the multiverse model provides further reason to doubt its validity. In a book review published in Nature, George Ellis notes that in a multiverse, the geometry of this universe will be open. In more technical terms, the total density parameter, Ω, of an open universe will be less than one. However, the best measurements for our universe have Ω total = 1.02 +/- 0.02 (in other words, one or greater). Multiverse supporters believe that this marginally negative result will disappear as more precise measurements are made, but it is not encouraging when the first tests of a model tend toward falsification. Beyond this one test, no experimental evidence exists that would distinguish a multiverse from a universe. Until such evidence exists, nothing should compel a scientist -- or a nonscientist -- to accept a multiverse model as the final word."[85]

Assumes the Multiverse Would Generate Universes with Different Constants

Every multiverse theory requires some sort of universe-generating mechanism to generate new universes within the multiverse. Why think the universe-generating mechanisms would generate universes with different values for the physical constants rather than trillions of identical universes?

Commits the Gambler's Fallacy

The gamblers' fallacy is committed when one thinks a particular outcome becomes more likely because it has been preceded by other outcomes. For example, your chances of rolling a die and getting a six are one in six. If a gambler rolled the die five times and did not get a six, but thinks that his next roll is more likely to be a six given his past five rolls, he commits the gambler's fallacy. The odds that he will roll a six are no better on his sixth try than on his first: one in six.

The same is true of the universe. Even if trillions of life-prohibiting universes have been created in the past, it doesn't follow that the next one is more likely to be a life-permitting universe. The probability that any new universe is fine-tuned for intelligent life is the same as every other universe. Just because trillions of non-life-permitting universes have already been tried does not make it more likely that the next universe will be life-permitting.

Passes the Buck

Proposing a multiverse to explain the fine-tuning of our universe just moves the fine-tuning problem back one level because the multiverse generator itself would have to be finely-tuned in order to generate billions of universes with different physical constants and/or physical laws.

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[84]Anna Ijjas, Paul Steinhardt, Abraham Loeb, "Pop Goes the Universe"; available from https://www.cfa.harvard.edu/~loeb/sciam3.pdf; Internet; accessed 03 March 2017.

[85]Jeff Zweerink, "How Does a Christian Respond to the Multiverse Concept?"; available from http://www.reasons.org/how-does-christian-respond-multiverse-concept; Internet; accessed 08 November 2011.

Defies Occam's Razor

The principle of Occam's Razor holds that we should not multiply causes beyond necessity. We should prefer the simplest explanation that is adequate to explain what needs to be explained. The fine-tuning of our universe can be explained by postulating a single designer. There is no need to postulate the existence of trillions of unseen universes. As Richard Swinburne notes, "It is crazy to postulate a trillion (causally unconnected) universes to explain the features of one universe, when postulating one entity (God) will do the job."[86] This is comparable to postulating the existence of trillions of random books to explain the origin of *Moby Dick* rather than postulating a single author.

Multiverse theories are not embraced because of the strength of the evidence. Multiverse theories are embraced because they are the only plausible naturalistic explanation for the fine-tuning. Scientists recognize that it's the multiverse or God, and their philosophical bias against God leads many to reject the more rational explanation in favor of a far-fetched theory for which we have no empirical evidence. In short, many scientists embrace the multiverse to avoid having to embrace God. If the shoe were on the other foot – and the multiverse pointed to theism – scientists would be quick to dismiss the notion on the basis that it was extremely speculative and unscientific. But when the multiverse supports naturalism against theism, suddenly the multiverse is a respectable scientific theory that sufficiently answers the fine-tuning problem.

Some may agree that multiverse theories are currently speculative and untested, but think we are not justified in adopting design until all multiverse theories can be ruled out as a possible explanation. This line of reasoning seems mistaken for at least three reasons. First, why think that preference should be given to naturalistic theories over a supernatural theory?

Second, arguments for the finitude of physical reality lead to the conclusion that the multiverse cannot be the ultimate explanation. The multiverse or multiverse generator itself would have a beginning, and thus needs a cause. The cause cannot be something physical, and thus it is beyond the realm of science to identify that cause.

Third, we should make judgments based on evidence we have in the present, not on the evidence we hope might be found in the future. The fact of the matter is that the evidence we have today clearly supports design rather than a chance hypothesis like the multiverse. If we are rationally obligated to draw conclusions and form beliefs based on what we know rather than what we don't know (or what could be true), then given the current state of the evidence it follows that we are rationally obligated to think the universe is designed.

Objection #3: *The methodology for determining the life-permitting range for the physical constants is flawed because it assumes you can change the value of one constant while all others remain the same. Perhaps if all constants were adjusted simultaneously there would be many more universes that are life-permitting.*

[86]Richard Swinburne, "Design Defended," *Think* (Spring 2004), page 17 as quoted in Flew, *There is a God*, 119.

Response #3: Victor Stenger is one such person who raises this objection, arguing that "one of the many major flaws with most studies of the anthropic coincidences is that the investigators vary a single parameter while assuming all the others remain fixed!"[87]

I do not find this objection persuasive. Some of the values are independent of one another in such a way that even if all were adjusted simultaneously, life would not be permitted. Consider, for example, the constants of gravity and the cosmological constant. The one does not depend on the other, and thus the probability of both laws falling in the life-permitting range is the product of both individual probabilities.[88]

The process is comparable to a soundboard. You can keep all the various sliders in their same location relative to one another as you move them up or down, but the fact remains that the sound produced after all sliders have been moved will be different (it will fall out of the "beautiful" range). To push the analogy a bit further, it is as if when one of the sliders is moved slightly it detonates a bomb inside the soundboard that blows the entire thing up. The fact of the matter is that there are some values of some constants that must be in a precise range in order for there to be a universe at all – not just a life-permitting universe. As Luke Barnes explains: "[T]he possibility of altering other constants to compensate the change in Q is not evidence against fine-tuning. Choose Q and, say, a_G at random and you are unlikely to have picked a life-permitting pair, even if our universe is not the only life-permitting one."[89] And again, "The fact that we can change the setting on one cosmic dial, so long as we very carefully change another at the same time, does not necessarily mean that FT is false."[90]

Objection #4: *While the constants of our physical laws are fine-tuned for life, it's possible that an entirely different set of physical laws would also be life-permitting.*

Response #4: This changes the subject entirely. The fine-tuning argument is not based on what is possible under different physical laws, but what is possible with different values for our physical laws. William Lane Craig explains:

> Scientists grappling with fine-tuning are *not* asking what the universe would have been like if it were governed by different laws of nature. Rather they are asking what the universe would have been like if one were to hold constant the present laws of nature but substitute different values for the physical constants appearing in them and different quantities for the initial conditions to which they are applied. Nobody knows what a universe governed by different laws would be like! But because we are talking about universes governed by the same laws, but with different numbers plugged in for the constants and quantities, we can calculate what kind of universe the laws would predict….[91]
>
> …
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> Some say we can't calculate the probability of a life-permitting universe because we don't know whether life would be possible in worlds with different physics. But that is not the argument. The argument is that given the laws of nature in our universe, the constants and quantities must assume a very narrow range to be life-permitting. That needs to be explained. We can test the chances that our universe would be life-permitting by changing the values of the constants and quantities in the equations and asking what the

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[87]Victor Stenger, *God: The Failed Hypothesis: How Science Shows That God Does Not Exist* (Amherst, NY: Prometheus Books, 2007), 148.

[88]Collins, 253-4.

[89]Barnes, 33.

[90]Barnes, 6.

[91]William Lane Craig, "Much Ado about Nothing: A Review Essay on *The Grand Design*," *Philosophia Christi*, Vol. 12, Number 2, 2010, p. 417.

result would be. Because the equations remain the same, we can predict what the world would be like, if, say, the gravitational constant were doubled.[92]

While we can't know what a universe would look like operating under different physical laws, we can know what impact it would have if a universe failed to have some of the physical laws our universe has. Luke Barnes lays these out in detail, and it isn't pretty:

- A universe governed by Maxwell's Laws "all the way down" (i.e. with no quantum regime at small scales) will not have stable atoms – electrons radiate their kinetic energy and spiral rapidly into the nucleus – and hence no chemistry (Barrow & Tipler, 1986, pg. 303). We don't need to know what the parameters are to know that life in such a universe is plausibly impossible.
- If electrons were bosons, rather than fermions, then they would not obey the Pauli exclusion principle. There would be no chemistry.
- If gravity were repulsive rather than attractive, then matter wouldn't clump into complex structures. …
- If the strong force were a long rather than short-range force, then there would be no atoms. Any structures that formed would be uniform, spherical, undifferentiated lumps, of arbitrary size and incapable of complexity.
- If, in electromagnetism, like charges attracted and opposites repelled, then there would be no atoms. As above, we would just have undifferentiated lumps of matter.
- The electromagnetic force allows matter to cool into galaxies, stars, and planets. Without such interactions, all matter would be like dark matter, which can only form into large, diffuse, roughly spherical haloes of matter whose only internal structure consists of smaller, diffuse, roughly spherical subhaloes.[93]

Objection #5: *Perhaps carbon-based life would be impossible if the physical constants did not have the precise values they do, but other forms of life might be able to exist if the values of the constants were different.*

Response #5: Victor Stenger *et al* object that the fine-tuning argument presupposes that all life forms must be carbon-based life. Perhaps the values of the physical laws could be outside of the range that permits carbon-based life, and non-carbon-based life forms could still emerge.

There are at least three problems with this. First, it is mere conjecture. No evidence is presented for thinking that non-carbon-based life could exist.

Second, it is never said how non-carbon-based life could achieve the self-reproducing complexity required of complex, intelligent beings. Carbon seems to be required for this.

Third, the fine-tuning of some constants are such that a small change would prohibit all life, including non-carbon-based forms. For example, if the cosmological constant were much larger the universe would be expanding at such an enormous rate that stars could never form, and thus the material constituents required for life would not form (and even if they did, they would have no energy source to drive their evolution).[94] William Lane Craig explains:

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[92]Craig, *Reasonable Faith: Christian Truth and Apologetics*, 160.
[93]Barnes, 18.
[94]Collins, 276.

> You might think that if the constants and quantities had assumed different values, then other forms of life might well have evolved. But this is not the case. By "life" scientists mean that property of organisms to take in food, extract energy from it, grow, adapt to their environment, and reproduce. The point is that in order for the universe to permit life so-defined, whatever form organisms might take, the constants and quantities have to be incomprehensibly fine-tuned. In the absence of fine-tuning, not even atomic matter or chemistry would exist, not to speak of planets where life might evolve![95]

Luke Barnes makes a similar point: "It is sometimes objected that we do not have an adequate definition of `an observer', and we do not know all possible forms of life. This is reason for caution, but not a fatal flaw of fine-tuning. If the strong force were weaker, the periodic table would consist of only hydrogen. We do not need a rigorous definition of life to reasonably conclude that a universe with one chemical reaction (2H → H2) would not be able to create and sustain the complexity necessary for life."[96]

Objection #6: *If the universe is fine-tuned for intelligent life, why is there so little life in the universe? To our knowledge, the only place life exists in the Universe is on planet Earth. The fine-tuning argument is akin to finding a single grasshopper in Antarctica, and then claiming that Antarctica is fine-tuned for the existence of grasshoppers. What's the point of a life-permitting universe if it only permits life on a tiny blue speck in the middle of a single galaxy among hundreds of billions of galaxies?*

Response #6: "FT [Fine-tuning] is not the claim that this universe is optimal for life, that it contains the maximum amount of life per unit volume or per baryon, that carbon-based life is the only possible type of life, or that the only kinds of universes that support life are minor variations on this universe. These claims, true or false, are simply beside the point."[97] Fine-tuning is simply the claim that a life-permitting universe is extremely unlikely, requiring an incomprehensible amount of precision in its physical constants and initial conditions. It makes no claim about how much life there will be or for how long that life will remain in existence.

This objection is nearly impossible to satisfy. Even if every single planet in the entire universe were teeming with life, given the vastness of space, life would still occupy such a miniscule amount of space so as to be virtually unnoticeable. The number of life forms would always be dwarfed by the number of non-living things.

The rarity of life in the universe is not evidence against fine-tuning, but it may be evidence against atheism and for theism. In a life-permitting universe, we might expect for life to evolve all throughout the universe. If life only exists in a single location throughout the entire universe, perhaps this points us to the activity of a Creator who intentionally created life on Earth for His own unique purposes.

Objection #7: *Any universe is improbable. It's like cards. It's just as improbable to draw a hand of consecutive spades as it is to draw a hand of four aces. Just because this universe is improbable does not mean it is designed*.

Response #7: The fine-tuning argument is not that it's improbable that *this* universe exists, but that it's improbable that a life-permitting universe exists. The existence of any universe is improbable, but the existence of a life-permitting universe is extremely improbable. If you plotted out all of the possible

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[95]William Lane Craig, "Five Arguments for God"; available from http://thegospelcoalition.org/publications/cci/five_arguments_for_god/; Internet; accessed 10 February 2010.

[96]Barnes, 63.

[97]Barnes, 3.

universes on a large canvas, marking a blue dot for each life-permitting universe and a red dot for each life-prohibiting universe, you would end up with a blue image containing a few specks of red here and there.[98] Given how improbable a life-permitting universe is, why is it that we are living in such a universe?

Consider another analogy. Imagine a large vat containing three billion black marbles and one white marble. You are tasked with pulling out one marble. The chances of you pulling out any single marble are the same: one in three billion. That means it is just as improbable that you would pull out marble #19 as it is that you would pull out marble #1,538,129,409. However, what if your goal was to pull out the lone white marble? While the chances of pulling out any particular marble is very low, the chances of pulling out the white marble on the first try is even more improbable. If one was able to do so, we would assume that this was design rather than chance.[99]

How about one more analogy for good measure? A teacher receives two, three-page papers containing 1500 words that are identical in every detail except for the author's name. Since any combination of 1500 words is equally improbable, the combination of words on Jimmy's paper is equally probable to the combination of words on John's paper. However, no teacher would shrug this off to mere chance. She would immediately conclude that one of the boys cheated. Why? Because one paper conforms to an independent, improbable pattern. It's not the improbability of an event alone that eliminates chance as an explanation, but that it conforms to some functionally significant pattern.[100]

Objection #8: *Supersymmetry can explain the fine-tuning.*

Response #8: Victor Stenger says the problem of fine-tuning can be solved via supersymmetry. Supersymmetry is an extension of string theory. String theory was devised to explain the origin of the four fundamental forces (bosons carry these forces in the standard model of particle physics). It did not explain matter (fermions explain matter in the standard model), however, so it could not be applied to our universe in toto. To extend the application of string theory to our entire universe, string theorists came up with the idea of supersymmetry, which holds that for every bosonic elementary particle there exists a corresponding fermionic particle.

If supersymmetry were true, then string theory could explain the fine-tuning of the physical constants. However, since string theory can't generate different initial conditions for the universe, it can't explain the fine-tuning of the initial conditions. One would have to employ a second theory (inflationary cosmology) to do that.[101] In other words, the full range of fine-tuning can only be explained by invoking the combination of two theoretical models of physics.

Do we have any empirical reason to believe that either model is true? No. String theory is very speculative. It hasn't even had all of its mathematical equations worked out yet, and there is no empirical evidence that confirms the theory against competing models. Some would argue that it has

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[98]I owe this analogy to William Lane Craig.

[99]I credit this analogy to William Lane Craig.

[100]Stephen C. Meyer, *Signature in the Cell: DNA and the Evidence for Intelligent Design* (New York: Harper One, 2009), 181-7.

[101]Only the cyclic ekpyrotic model of string theory can explain both levels of fine-tuning, but this model has a bloated ontology, meaning it must postulate a number of entities for which we have evidence that they exist. See Stephen C. Meyer, *The Return of the God Hypothesis: Three Scientific Discoveries that Reveal the Mind Behind the Universe* (New York: HarperOne, 2021), 335-6, 502.

already been falsified. For example, if supersymmetry were true, we should be able to detect some of the particles in high-energy particle supercolliders, but we haven't been able to do so.[102]

Inflationary cosmology is also speculative and there is no direct, empirical evidence for it. For example, inflationary cosmology requires the existence of an inflaton field, but no such field has ever been detected. To declare, then, that supersymmetry or inflation has explained away the fine-tuning is tenuous at best.

Philosopher of science and specialist in the area of fine-tuning, Robin Collins, details other problems with postulating supersymmetry to explain away the fine-tuning that are worth quoting at length:

> This solution faces a major difficulty: even if supersymmetry exists, it is presently a broken symmetry and thus cannot solve the cosmological constant problem. As astrophysicist John Peacock notes, "supersymmetry, if it exists at all, is clearly a broken symmetry at present day energies; there is no natural way of achieving this breaking while retaining the attractive consequence of a zero cosmological constant, and so the Λ problem remains as puzzling as ever" (1999, p. 268).
> Further, even if some other symmetry could be discovered that would force the contributions of the bosonic or fermionic fields to cancel each other out, the first two contributions to the cosmological constant mentioned earlier would remain – that is, those arising from the Higgs field and the inflaton field. In order to get a zero cosmological constant, one would have to postulate some law, symmetry, or other mechanism that forced the sum of all contributions to the cosmological constant to be zero. In order to get this suggestion to work, physicists would have to either (a) abandon inflationary cosmology, which requires that the effective cosmological constant be initially very large and then fall off to near zero, or (b) invoke some special law, symmetry, or "mechanism" that selectively requires that the cosmological constant be zero at the end of the inflationary period. If options (a) and (b) are both rejected, one will be left with the fine-tuning problem generated by a large effective cosmological constant required for inflation that must drop off to near zero after inflation in order for life to exist.
> Further, supposing that option (a) or (b) are chosen, steps (2) and (3) are still required to account for the small, nonzero effective cosmological constant today. In typical models of quintessence, Λq "tracks" the matter and radiation density of the universe – that is, Λq is some function of these densities. One problem here is that unless the function is both natural and simple, without any adjustable parameters needed to make Λq < Λmax, the problem of fine-tuning will simply re-arise: if that function is not simple or natural, or such a parameter is needed, then the question will arise as to why that function or parameter is such that the value of the effective cosmological constant is within the life-permitting range instead of falling outside the life-permitting range. So far, no such natural function has been found, and it is widely argued that current models of quintessence require fine-tuning, especially when combined with inflationary cosmology.
> …
> In sum, it is conceivable that by postulating the right set of laws–symmetries–mechanisms, physicists will be able to explain the fine-tuning of the effective cosmological constant in a non-*ad hoc* way. Nonetheless, two points should be made. First, any such explanation will require the hypothesis of just the right set of laws. At best, this will merely transfer the fine-tuning of the cosmological constant to that of the laws of nature; even if those laws of nature are deemed "natural," one would still have to have the right set of laws to eliminate the fine-tuning of the cosmological constant.[103]

Objection #9: *It is impossible to calculate the probability of the initial conditions of the universe or the values of the physical constants because we have no backdrop against which to compare our universe. The odds of some* x *happening can only be calculated when you know how many other possible*

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[102]Meyer, *The Return of the God Hypothesis*, 344.
[103]Collins, 218-9.

outcomes there are. We can't know that. We only know what the actual universe looks like – not all the ways the universe could have been. As such, we cannot calculate the probability that we would end up with the universe we did.

Response #9: Keith Parsons is an example of someone who raises this objection. He argues that there is no way of determining how probable or improbable the universe is:

> If atheism is correct, if the universe and its laws are all that is or ever has been, how can it be said that the universe, with all of its "finely tuned" features, is in any relevant sense probable or improbable? *Ex Hypothesi* there are no antecedent conditions that could determine such a probability. Hence, if the universe is the ultimate brute fact, it is neither likely nor unlikely, probable nor improbable; it simply is. Further, even if the universe were somehow improbable, it is hard to see on the hypothesis of atheism how we could ever know this. If we were in the position to witness the birth of many worlds – some designed, some undesigned – then we might be in a position to say of any particular world that it had such-and-such a probability of existing undesigned. But we simply are not in such a position. We have absolutely no empirical basis for assigning probabilities to ultimate facts.[104]

According to this objection, for all we know, there may be trillions upon trillions of possible ways a universe could exist – or, perhaps ten, or even just one. Does this mean, then, that there is no rational basis for the conclusion that the fine-tuning of our universe is improbable given atheism?

It is true that probabilities are often calculated against the background knowledge of how many possible outcomes there could be. For example, we can calculate the odds of a coin toss landing on tails as 50% because we know that there are only two possible outcomes based on the fact that coins only have two sides. If a coin had seven sides, the probabilities would change.

When it comes to the beginning of the universe, however, all we can observe is the actual universe. We can't observe any possible universes. Does our inability to observe other possible universes mean we cannot conclude that the actual universe is improbable with respect to its initial conditions and physical constants? No. As Robin Collins has noted, this objection confuses statistical probability with epistemic probability. Epistemic probability assesses how reasonable it is to believe a proposition, whereas statistical probability concerns itself with statistical likelihoods based on chance processes. An example of epistemic probability is the theory of common ancestry. When someone says this is probably true based on the genetic and paleographic evidence, they are not making a statement about statistical probability. The same is true of atomic theory. In such matters we cannot assess statistical probability because the events are singular, non-repeatable affairs. And yet clearly, we can still assess how probable some explanation is given the evidence.

If someone created a 20-sided die, with each side being perfectly symmetrical, we would not need to perform a statistical analysis to determine the chances that any given number be rolled. There is an epistemic probability (based on the principle of indifference) that any given number will come up one in 20 times. We don't know this from experience since no one has ever rolled a 20-sided die to generate the relative frequencies of which numbers come up, but rather on the basis of its epistemic probability rooted in the principle of indifference.[105] So while it is true that one may not be able to adequately calculate the *statistical* probability of our universe springing into being with the precise values required

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[104]Keith Parsons, "Is there a Case for Christian Theism?" in J. P. Moreland and K. Nielsen (eds.), *Does God Exist? The Great Debate* (Nashville, TN: Thomas Nelson. 1990), 182.

[105]Collins, 235.

of its laws to produce complex, intelligent life, that does not mean we cannot assess the *epistemic* probability of such. Given the vast range of physically possible states of the early universe and the physically possible values for the laws of nature, the precise values exhibited in our universe are extremely improbable and require an explanation.

Objection #10: *By describing these physical phenomena as "fine-tuning," you are presupposing design, or at least poisoning the well against naturalistic explanations.*

Response #10: "Fine-tuning" does not imply or assume design. It is a descriptive term used by both atheists and theists alike. Something is said to be fine-tuned if the range of life-permitting values is exceedingly small compared to the range of all physically possible values. The debate is not regarding the existence of fine-tuning, but how to explain it. Design is just one possible explanation for the fine-tuning. Other possibilities include chance and physical necessity. Since design is but one possible explanation or the fine-tuning, there is no basis for thinking that fine-tuning assumes design.