Evidence for God

(part 1 of 8): Fine Tuning of Physical Laws of Universe

What is Fine Tuning?

Over the past century, scientists have discovered that if certain properties of the universe were changed very slightly from what they are, we would not be here. They have to be within a very narrow range for our universe to make life possible and be habitable.

The universe is fine-tuned for the existence of intelligent life with a complexity and delicacy that literally defy human comprehension. The sensitivity of the 'habitability' of the universe to small changes is called 'fine-tuning.'

This was recognized about 60 years ago by Fred Hoyle who was not a religious person at the time he made the discovery. Scientists like Paul Davies, Martin Rees, Max Tegmark, Bernard Carr, Frank Tipler, John Barrow, and Stephen Hawking, to name a few, believe in fine-tuning. These are prominent names in cosmology as they are heard in the media whenever a news headline is made.

Types of Fine-Tuning

1. Fine tuning of the laws of nature.
2. Fine-tuning of the constants of physics.
3. Fine tuning of the initial conditions of the universe.

We will explore each category below:

1. Fine tuning of the laws of nature

There are two ways to look at this aspect of fine-tuning:

1. Precisely the right laws are needed for highly complex life to exist. If one of these were missing, such life would not be possible. To say that the laws are fine-tuned means that the universe must have precisely the right set of laws in order for highly complex life to exist. Perhaps this type of fine-tuning is the easiest of the three to understand.

Example 1: The law of gravity states that all masses attract each other. What would the universe be like if gravity did not exist? There wouldn't be any stars or planets. Matter would be equally distributed around the universe with no place for life to form or energy sources like the sun that provide food to plants through photosynthesis that in turn become food for animals.

Example 2: One type of force can play multiple roles in this very well designed system. For example, the electromagnetic force refers to the combination of electric and magnetic forces. James Clerk Maxwell unified the two forces in 1800's.

If there were no electromagnetic force, there would be no atoms because there would be no force to hold the negatively charged electrons with the positively charged protons that allow for chemical bonds. There would be no building blocks of life as there would be no chemical bonding, and therefore no life.

The electromagnetic force plays another role in light which is a type of electromagnetic radiation. It allows energy to transfer from the sun to our planet. Without this energy we would not exist.

2. Harmony between nature and mathematics: Only in the 20th century have we come to understand that what we observe in nature can be described by only a few physical laws, each of which is described by simple mathematical equations. Just the fact that these mathematical forms are so simple and few in number that they can all be written on one sheet of paper is amazing.

Table1. The Fundamental Laws of Nature

- Mechanics (Hamilton's Equations)

$$p = -\frac{\partial H}{\partial q}$$
$$q = -\frac{\partial H}{\partial p}$$

- Electrodynamics (Maxwell's Equations)

$$F^{\mu\upsilon} = \partial^{\mu} A^{\upsilon} - \partial^{\upsilon} A^{\mu}$$

$$\partial_\mu F^{\mu\nu} = j^\nu$$

- Statistical Mechanics (Boltzmann's Equations)

$$S = -k \int f \log f \, dv$$

$$\frac{dS}{dt} \geq 0$$

- Quantum Mechanics (Schrödinger's Equations)

$$I\,\mathrm{h}|\psi\rangle = H|\psi\rangle$$

$$\Delta X \Delta P \geq \frac{\mathrm{h}}{2}$$

- General Relativity (Einstein's Equation)

$$G_{\mu\nu} = -8\pi G T_{\mu\nu}$$

For life to exist, we need an orderly and intelligible universe. Furthermore, order at many different levels is required.

For instance, to have planets that circle their stars, we need Newtonian mechanics.

For there to be multiple stable elements of the periodic table to provide a sufficient variety of atomic "building blocks" for life, we need the atomic structure given by the laws of quantum mechanics.

We need the orderliness in chemical reactions that is the consequence of Boltzmann's equation for the second law of thermodynamics.

And for an energy source like the sun to transfer its life-giving energy to a habitat like Earth, we require the laws of electromagnetic radiation that Maxwell described.[1]

Physicist and Nobel Prize winner Eugene Wigner in his widely quoted paper,*The Unreasonable Effectiveness of Mathematics in the Physical Sciences* notes that scientists often take for granted the remarkable - even miraculous - effectiveness of mathematics in describing the real world. He says:

"The enormous usefulness of mathematics is something bordering on the mysterious…There is no rational explanation for it…The miracle of the

appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve."[2]

Footnotes:

[1] Bradley, Dr. Walter. Is There Scientific Evidence for the Existence of God? How the Recent Discoveries Support a Designed Universe. On-line. Available from Internet,

http://www.leaderu.com/real/ri9403/evidence.html, accessed 10 March 2014.

[2] Wigner, Eugene. 1960. The Unreasonable Effectiveness of Mathematics in the Physical Sciences. *Communications on Pure and Applied Mathematics,* vol. 13: 1-14.

(part 2 of 8): Fine-Tuning of Constants & Initial Conditions

2. Fine-Tuning of the Constants

What is a constant? What is meant are the constants of physics. When the laws of nature are expressed as mathematical equations, like the force of gravity, the electromagnetic force, and the subatomic 'weak' force, you find certain symbols in them that stand for numbers that don't change. These unchanging numbers are called 'constants' that occur in the laws of physics.

The laws of nature do not determine the value of these constants. There could be a universe governed by the *same* laws, but with *different* values of these constants. Therefore, the actual values of these constants are *not* determined by the laws of nature. Depending on the values of those constants, a universe governed by the *same* laws of nature will look very *different*.

There are at least 20 independent constants and factors that are fine tuned to a high degree of precision for life to be possible in the universe. It is estimated that every year roughly another number is added to the list.[1]

G: Example of a Finely-Tuned Constant

An example of a constant is the Gravitational constant – designated by G – which determines the strength of gravity via Newton's Law of Gravity.

$$F = \frac{G\, m_1 m_2}{r^2}$$

F is the force between two masses m_1 and m_2 that are at a distance r apart. The actual value of G is 6.67×10^{-11} N $^{m^2}/_{kg^2}$. Increase or decrease G and the force of gravity will correspondingly increase or decrease.

If one increased the strength of gravity by one part in 10^{34}, even single-celled organisms would be crushed, and only planets less than around 100 feet in diameter would sustain life with our brain-size. Such planets, however, could not sustain an ecosystem to support life of our level of intelligence. In fact even a basic ecosystem can barely be possible on such a place.

If fact, if G were increased by a mere 64-fold, the gravitational force of the surface of any planet that could retain an atmosphere would be at least 4 times as large. A 400-fold increase in G would result in any such planet having a surface force at least 10 times as large. Such a planet would be far less ideal than earth for humans. On the other hand, a small decrease in G would negatively affect the planet's hydrologic cycle, this also making any habitable planet less ideal.[2]

3. Fine-Tuning of the Initial Conditions of the Universe

In addition to the constants, there are certain arbitrary quantities that are just put in as initial conditions on which the laws of nature operate. Because these quantities are arbitrary, they are also *not* determined by the laws of nature.

I will first give a simple example to explain what it means. When I throw a ball, I throw it at a certain angle and with certain speed. The angle and speed are the 'initial conditions.' After I throw it, the ball follows a certain course. Where the ball lands will depend on the 'initial conditions.' The course taken by the ball is calculated by using the law of gravity, which is one of the laws of physics.

Now, take an example of entropy (thermodynamic disorder) in early universe. It is an 'initial condition' in the Big Bang model similar to the speed and angle for the ball in the example above. Just like the example of the ball, after the Big Bang, the laws of physics take over and determine how the universe will develop from there on. If the initial entropy (an initial condition) of the universe had been different, the laws would predict a very different universe.

Here is the amazing part. Scientists have discovered that that these constants and initial conditions must fall into an extremely narrow range of values for the universe to exist. This is what is meant by 'the universe has been fine tuned for life.'

Footnotes:

[1] Spitzer, Robert. 2010. N*ew Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophy*. Grand Rapids/Cambridge: Wm.B. Eerdmans Publishing Co. 50-56.

[2] The calculations were done and presented by Dr. Robin Collins, Professor of Philosophy and Chair of the Department of Philosophy at Messiah College, at Pepperdine University lecture titled '*Is [it] True?*' hosted by the Veritas Forum on Feb 18, 2013.

part 3 of 8): Four Examples of Fine Tuning

1. Fine-tuning to Allow a Habitable Planet

When we think of the specific conditions that are needed nearer home in our solar system and on earth, we find that there are a host of parameters that must be just right in order for life to be possible. A number of factors must be fine-tuned in order to have a planet that supports life:

- It must be a single star solar system, in order to support stable planetary orbits.
- The sun must have the right mass. If it was larger, its brightness would change too quickly and there would be too much high energy radiation. If it was smaller, the range of planetary distances able to support life would be too narrow; the right distance would be so close to the star that tidal forces would disrupt the planet's rotational period. Ultraviolet radiation would also be inadequate for photosynthesis.
- The distance from the earth to the sun must be just right. Too near and water would evaporate, too far and the earth would be too cold for life. A change of only 2% and all life would cease.
- Earth must have sufficient mass in order to retain an atmosphere.
- Surface gravity and temperature are also critical to within a few percent for the earth to have a life-sustaining atmosphere – retaining the right mix of gases necessary for life.

- Earth must rotate at the right speed: too slow and temperature differences between day and night would be too extreme, too fast and wind speeds would be disastrous.
- The earth's gravity, axial tilt, rotation period, magnetic field, crust thickness, oxygen/nitrogen ratio, carbon dioxide, water vapor and ozone levels have to be just right.

Astrophysicist Hugh Ross[2] lists many such parameters that have to be fine-tuned for life to be possible, and makes a rough but conservative calculation that the chance of one such planet existing in the universe is about 1 in 10^{30}.

2. Fine-Tuning of Carbon 'Resonance'

Life requires plenty of carbon that makes complex molecules. Carbon is formed either by combining three helium nuclei or by combining nuclei of helium and beryllium. Carbon is like the hub wheel in a tinker toy set: you can bind other elements together to more complicated molecules (carbon-based life), but the bonds are not so tight that they can't be broken down again to make something else.

Eminent mathematician and astronomer Fred Hoyle, found that for this to happen, the nuclear ground state energy levels have to be fine-tuned with respect to each other. This phenomenon is called 'resonance.'

The carbon resonance level is determined by two constants: the 'strong force' and 'electromagnetic force'. If you mess with these forces even slightly, you either lose the carbon or the oxygen. If the variation were more than 1% either way, the universe could not sustain life.

Hoyle later confessed that nothing had shaken his atheism as much as this discovery.[3]

3. Fine-Tuning of the Strong Nuclear Force

The "strong force" is the force that binds protons and neutrons together in nucleus. If the strong force constant were 2% stronger, there would be no stable hydrogen, no long-lived stars, no hydrogen containing compounds. This is because the single proton in hydrogen would want to stick to something else so badly that there would be no hydrogen left!

If the strong force constant were 5% weaker, there would be no stable stars and few elements besides hydrogen. This is because you would not be able to build up the nuclei of the heavier elements, which contain more than 1 proton.

So, whether you adjust the strong force up or down, you lose stars that serve as source of energy or you lose complex chemistry which is necessary for life.

4. Ratio of Strong Nuclear Force to Electromagnetic Force

If the ratio of the strong nuclear force to the electromagnetic force had been different by 1 part in 10^{16}, no stars could have been formed. Increase it by only 1 part in 10^{40} and only small stars can exist, decrease it by the same amount and there will only be large stars. You must have both large and small stars in the universe. The large ones produce elements in their thermonuclear furnaces and it is only the small ones that burn long enough to sustain a planet with life.[4]

To put 10^{40} in perspective, having a precision of one part in 10^{30} (a much smaller number) is like firing a bullet and hitting an amoeba at the edge of the observable universe!

Arno Penzias, an American physicist and Nobel laureate who co-discovered the cosmic microwave background radiation which helped establish the Big Bang, sums up what he sees,

> 'Astronomy leads us to a unique event, a universe which was created out of nothing, one with the very delicate balance needed to provide exactly the right conditions required to permit life, and one which has an underlying (one might say 'supernatural') plan.'[5]

Footnotes:

1. Ross, Hugh. 2001. *The Creator and The Cosmos*. Colorado Springs, Co: NavPress. 145-157.
2. Bradley, Dr. Walter. Is There Scientific Evidence for the Existence of God? How the Recent Discoveries Support a Designed Universe. On-line. Available from Internet, http://www.leaderu.com/real/ri9403/evidence.html, accessed 10 March 2014
3. Spitzer, Robert. 2010. New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophy. Grand Rapids/Cambridge: Wm.B. Eerdmans Publishing Co. 50-56.

[2] Davies, Paul. 1988. *The Cosmic Blueprint*. New York: Simon and Schuster. 138-139.

[3] Gingerich, Owen. 2000. "Do The Heavens Declare?" in *The Book of the Cosmos*, ed. Danielson, Richard Dennis. Cambridge, MA: Perseus Publishing. 524-525.

[4] Davies, Paul. 1983. *God and the New Physics*. London: J. M. Dent and Sons.

[5] Margenau and Varghese eds. 1992. *Cosmos, Bios, and Theos*. La Salle, IL: Open Court. 83.

First, physicists identify four fundamental forces of nature. In terms of increasing strength, they are gravity (G_0), weak force (10^{31} G_0), electromagnetic force (10^{37} G_0), and the strong nuclear force ($10^{40}G_0$).

Second, since *extreme* examples of fine tuning deal with extraordinarily large numbers, we need to have an idea of just how big they are. It will give us some perspective of how delicate fine tuning is:

- average number of cells in a human body is 10^{13} (i.e. 10 trillion)
- age of the universe is roughly 10^{17}s
- number of sub-atomic particles in the known universe is estimated to be 10^{80}

Keeping these numbers in mind, consider the following three examples of fine-tuning:

1. Weak Nuclear Force

One of them, the 'weak nuclear force' which works inside the nucleus of an atom is so sensitive (finely tuned) that even an alteration of one part in 10^{100}would prevent life in the universe![1]

2. Cosmological Constant

The cosmological constant is a term in Einstein's theory of gravity that has to do with acceleration of the universe's expansion. It is described as self-stretching property of space (or more accurately space-time).[2] Unless it is within an extremely narrow range around zero, the universe will either collapse or it will expand too rapidly for galaxies and stars to form. The constant is fine-tuned to an unimaginably precise degree. If it were changed by as little as one part in 10^{120}, the universe would have no life![3]

3. Penrose Number: The *Most* Extreme Example of Fine Tuning

That is not it. According to standard cosmology model, the accepted model of the universe today, if you were to go back some 14 billion years, you can think of the universe as condensed to less than the size of a golf ball. The initial state of the space-time, and thus gravity, of the early universe had very low entropy[4]. This low entropy is required for a habitable universe in which high-entropy structures like stars are formed. The 'mass-energy' of the initial universe had to be precise to get galaxies, planets, and for us to exist. The most extreme example of fine-tuning has to do with the distribution of mass-energy at that time.

Just how precise?

Roger Penrose of Oxford University, and one of Britain's leading theoretical physicists and cosmologists, has calculated that the odds of a low-entropy state to exist by chance alone are one out of $10^{10^{123}}$ - the Penrose number. He wrote in his book, 'The Road to Reality,' "Creation of the universe, a fanciful description! The Creator's pin has to find a tiny box, just 1 part in $10^{10^{123}}$ of the entire phase-space volume, in order to create a universe with as special a Big Bang as that we actually find."[5]

In his other book, 'The Emperor's New Mind,' he observed, "In order to produce a universe resembling the one in which we live, the Creator would have to aim for an absurdly tiny volume of the phase space of possible universes – about $1/10^{10^{123}}$ of the entire volume, for the situation under consideration."[6]

Let us try to get an idea of what type of a number are we talking about?

You don't have enough particles in the universe (that we know of) to write down all the zeroes! It is like a ten raised to an exponent of:

10000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000.

This number is so large, that if every zero were 10 point type, it will fill up a large portion of our universe![7]

That is why we will explain it with four illustrations.

> First, balancing a billion pencils all simultaneously positioned upright on their sharpened points on a smooth glass surface with no vertical supports does not even come close to describing an accuracy of one part in 10^{60}.[8]
>
> Second, this is much more precision than would be required to toss a dart and hit a penny across the universe![9]
>
> A third illustration suggested by astrophysicist Hugh Ross[10] may help. Cover America with coins in a column reaching to the moon (380,000 km or 236,000 miles away), then do the same for a billion other continents of the same size. Paint one coin red and put it somewhere in one billion of the piles. Blindfold a friend and ask her to pick the coin. The odds of her picking it are 1 in 10^{37}.

All these numbers are extremely small when compared to the precise fine-tuning of the Penrose number, the *most extreme* example of fine-tuning that we know of.

In summary, the fine-tuning of many constants of physics must fall into an exceedingly narrow range of values for life to exist. If they had slightly different values, no complex material systems could exist. This is a widely recognized fact.

Footnotes:

[1] Davies, Paul. 1980. *Other Worlds*. London: Dent. 160-61, 168-69.

[2] Ross, Hugh. 2001. *The Creator and The Cosmos*. Colorado Springs, Co: NavPress. 46.

[3] Krauss, Lawrence. 1998. *The Astrophysical Journal*. 501: 465

[4] Entropy is a measure of disorder.

[5] Penrose, Roger. 2004. The Road to Reality: A Complete Guide to the Laws of the Universe. London: Jonathan Cape. 730.

[6] Penrose, Roger. 1991. *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*. New York: Penguin Books. 343.

[7] Spitzer, Robert. 2010. *New Proofs for the Existence of God: Contributions of Contemporary Physics and Philosophy*. Grand Rapids/Cambridge: Wm.B. Eerdmans Publishing Co. 59.

[8] Ross, Hugh. 2001. *The Creator and The Cosmos*. Colorado Springs, Co: NavPress. 151.

[9] Lecture at Pepperdine University titled '*Is [it] True?*' hosted by the Veritas Forum on Feb 18, 2013.

[10] Ross, Hugh. 2001. *The Creator and The Cosmos*. Colorado Springs, Co: NavPress. 150.

(part 5 of 8): Objections to Fine Tuning

Three Objections to Fine-Tuning[1]

1. Someone might say, 'but if the constants and initial values had been different, maybe different forms of life might have evolved.'

By 'life' scientists mean the property of organisms to take food, convert it into energy, grow, adapt to their environment, and reproduce. In order for life to exist, constants and initial conditions have to be fine tuned otherwise, even the precursors of life – planets, galaxies, chemistry – would not exist! Again, the question is purely speculative.

2. Another objection might be, ‘what about universes governed by different laws of nature that allow radically different forms of life than those in our universe? Maybe constants and initial conditions in those universes aren’t fine-tuned?’

The answer to that question is irrelevant to explaining the fine tuning of *our* universe. We do not understand our universe well enough to delve into pure speculation about other universes that we do not know exist.

3. Someone might object, ‘you cannot change one parameter while holding all others constant. Changing another parameter might compensate for the life-inhibiting effects of a particular parameter change.’

The answer is that you cannot compensate for changes made to a parameter.[2] For example, reducing the weak force can be compensated by reducing the mass difference between the proton and neutron in the early universe. However, changing a parameter has multiple effects. Reducing the weak force also affects the explosion of massive star supernovae and radioactive decay.

Why does fine-tuning need an explanation?

Someone might say, ‘the universe just is, why is an explanation needed for fine-tuning?’[3]

It will be distinctly odd, as Keith Ward comments, ‘to think that there is a reason for everything, except for that most important item of all – that is, the existence of everything, the universe itself.’[4]

Imagine a universe-creating machine, like a giant safe with two types of dials. There are dials that fix the settings for laws of physics like gravity, electromagnetism, and the nuclear forces. It also has dials for Planck’s constant, one for the ratio of the neutron mass to the proton mass, one for the strength of the electromagnetic attraction, and so on. Initially, all dials have been set and fixed at particular numbers. These numbers are the constants of nature and they produce the universe we live in.

Let us say that you can change the dials of this universe generating machine. There is also a screen which shows you what would happen if you were to change the dials even by a little bit.

You change the dials and hit the preview button to see what might happen. You weaken the force of electromagnetism and the force of gravity just a little. Then you touch the preview button and see the results on a screen. Suddenly, stars, galaxies, and planets start falling apart! Then you increase

the dial of the electromagnetic force and suddenly, the planets are not the right size. They are too big for life. Also, stars burn up quickly.

What will you infer about the origin of these finely tuned dial settings?[5]

Most people find it hard to believe that a fine-tuned universe is just a fact that neither has nor requires an explanation. The universe just sprang into existence sounds about as scientific as answering the question why apples fall to the ground, by saying that they just do.[6]

Will anyone accept that a photograph of a face is simply the result of an ink spill? No one would ever accept an accident as an explanation. If they won't accept ink spill as an explanation for a photograph, how could anyone accept the universe to be fine-tuned without an explanation?

Furthermore, fine tuning is a well established scientific fact admitted by physicists who are no friends of theism. Even they cannot hide their awe of how finely-tuned our universe is:

> **Stephen Hawking**: 'It would be very difficult to explain why the universe should have begun in just this way, except as the act of a God who intended to create beings like us.'[7]
>
> 'The remarkable fact is that the values of these numbers (i.e. the constants of physics) seem to have been very finely adjusted to make possible the development of life.'[8]
>
> **Steven Weinberg**: 'There may be a cosmological constant in the field equations whose value just cancels the effects of the vacuum mass density produced by quantum fluctuations. But to avoid conflict with astronomical observation, this cancellation would have to be accurate to at least 120 decimal places. Why in the world should the cosmological constant be so precisely fine-tuned?'[9]
>
> **Dr. Dennis Sciama**: former director of Cambridge University Observatories, said, 'If you change a little bit the laws of nature…it is very likely that intelligent life would not have been able to develop.'[10]
>
> **Martin Rees**: 'The possibility of life as we know it depends on the values of a few basic physical constants and is, in some respects remarkably sensitive to their numerical values. Nature does not exhibit remarkable coincidences.'[11]
>
> **Paul Davies**: '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.'[12]

Footnotes:

[1] I am grateful to Dr. William Lane Craig, Dr. Robin Collins, Dr. John Lennox, and Dr. Guillermo Ganzalez. Many of these questions and answers were compiled from their lectures and written works.

[2] S.M. Barr and Almas Khan. 2007. Anthropic tuning of the weak scale of m_u/m_d in two-Higgs-doublet models. On-line. Available from Internet, http://arxiv.org/pdf/hep-ph/0703219v1.pdf, accessed 14 Mar 2014.

The research paper explores two-dimensional tuning: what happens when you change the size of the up and down quarks simultaneously? They found that 9 distinct effects are produced by the simple change in the masses of up and down quarks. Up and down quarks are fundamental particles of nature that make up protons and neutrons.

[3] Bertrand Russell wrote, 'The universe is just there, and that's all.'

Russell, Bertrand and Copleston, Frederick. 1964. Debate on the Existence of God in *The Existence of God*, ed. John Hick. New York: Macmillan. 174-75.

Tryton echoed Russell, 'Our universe is simply one of those things which happen from time to time.' Tryton, E. 1971. Is the Universe a Vacuum Fluctuation? *Nature* 246:396.

Carl Sagan began his bestseller with the words, 'The cosmos is all there is, all there ever was, and all there ever will be.' (Sagan, Carl. 1985. *Cosmos*. New York: Ballatine Books. 1.)

[4] op. cit. p. 23.

[5] Richards, Jay. 2008. Why Are We Here: Accident or Purpose? in *Intelligent Design 101: Leading Experts Explain the Key Issues*, ed., Wayne House, H. Grand Rapids: Kregel. 141-142.

[6] Lennox, John C. 2009. *God's Undertaker: Has Science Buried God?* Oxford: Lion. 64.

[7] Hawking, Stephen. 1998. *A Brief History of Time*. New York: Bantam. 127.

[8] Hawking, Stephen. 1998. *A Brief History of Time*. New York: Bantam. 128.

[9] Weinberg, Steven. 1993. The First Three Minutes: A Modern View of the Origin of the Universe. New York: Basic Books. 186-187.

[10] 'The Anthropic Principle.' A BBC Special.

[11] Martin Rees quoted by Ross, Hugh. 2001. *The Creator and The Cosmos*. Colorado Springs, CO: NavPress. 158.

[12] Davies, Paul. 1988. The Cosmic Blueprint: New Discoveries in Nature's Creative Ability To Order the Universe. New York: Simon and Schuster. 203.

(part 6 of 8): How Can We Explain Fine-Tuning?

To many people the evidence of fine-tuning immediately suggests divine creation as the explanation. Even some atheists, at times, could not resist

admitting this commonsense interpretation. Theoretical physicist and popular science writer Paul Davies wrote, 'The impression of design is overwhelming.'[1] After discovering one of the first cases of fine-tuning, the late astrophysicist, Fred Hoyle declared, 'A common sense interpretation of the facts suggests that a superintellect has monkeyed with physics, as well as with 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.'[2]

Nevertheless, to exhaust all explanations, first, we will separate two words: fine tuning and design. Second, we will apply mutually exhaustive causal explanations to eliminate the least likely possibilities to pick the best one.

Fine tuning is a neutral term that says nothing how to explain it. It just means that the range of values of constants and initial conditions of the universe at the time of the Big Bang were extremely narrow and the physical laws are precisely set. If the values of even one of these constants or initial conditions were changed by the breadth of a hair, there would be no life in the universe today. The delicate balance required for life would have been upset.

Next, let us explore all other possible explanations of fine-tuning:

Universe is Self-Explanatory

Some say the universe is its own explanation, i.e. it is self-explanatory.[3]

Don't worry if you don't understand what it means because the idea contradicts itself. It is logically impossible for a cause to bring about an effect without being in existence. John Lennox observes, 'Attempts to argue that the universe is self-explanatory turn out to be as self-contradictory as the simple acceptance of a beginning as a brute fact is unsatisfactory.'[4]

Necessity

'Necessity' means that the constants and quantities *must* have the values they do. But, why does the universe has to permit life? Why do the constants and initial conditions have to be what they are?

There are no good answers to these questions, therefore, physical necessity is implausible since there is *no* evidence that life-permitting universes are necessary.

As a matter of fact, life-prohibiting universes are more *likely* than a life-permitting universe. As Paul Davies wrote, "It seems, then, that the physical universe does not have to be the way it is: it could have been otherwise."[5]

Universe Was Either Created by Physical Laws or Was Self-Generated

If a cake cannot generate itself, how can a universe generate itself? It is hard to believe, but some atheists suggest that the universe was brought into existence by a theory, or laws of physics, or mathematics.[6]

First, ascribing intelligence to mathematical laws and believing they could be intelligent is non-sense.

Second, explanations of physical phenomenon like the rising of the sun from the East with laws of physics are descriptive and predictive, but not creative. Who created these laws? Newton's law of gravitation does *not* create gravity or *cause*anything to happen. Replace the universe with a jet engine. Will we say someone made it for a specific purpose or shall we dismiss the agent who made it and say the jet engine arose naturally from the physical laws? This will be absurd. God does not compete or conflict with the laws of physics as an explanation. Laws of physics can explain how the jet engine works, but not how it came about in the first place.[7] Lennox put it well in one of his lectures, 'nonsense remains nonsense even if talked by famous scientists.'

Chance or Brute Force?

Could the fine-tuning be due to chance? Could it be an accident that all constants and initial conditions just fell into the range that allows life? The problem is that the chances of a life-permitting universe to exist are so *remote*that this alternative becomes unreasonable. No respectable physicist (including atheists), believes that fine-tuning can be explained by pure chance.

Someone might ask, "when does something become so improbable that it becomes impossible?" Williams Dembski, a mathematician, attempted to answer the question in his book, *The Design Inference*. You consider the number of particles in the universe *and* you also consider the number of seconds in the universe, which he places at 10^{25}. Then he multiplies this by 10^{45} as the number of events, or reactions, that could take place per second. On this basis, he arrives at a probability which is one half times one out of 10^{150}. Anything that falls beyond that probability bound, he says, is not different from impossibility.

Furthermore, the objection is answered with an illustration given by John Leslie.[8] Let us say you are dragged in front of a firing squad of 100 trained shooters standing at point-blank. You hear 'Ready! Aim! Fire!' You then hear the sound of guns, but, amazingly, you are still alive! Did all the 100 shooters miss? What conclusion will you reach?

Would you say, 'guess I shouldn't be surprised they all missed! After all, had they not missed, I would not be here! There is nothing more to explain!'

No person in their right mind will accept this explanation. In light of the enormous improbability that *all* shooters missed, a *reasonable* conclusion will be they all missed on *purpose*.

Footnotes:

[1] Davies, Paul. 1988. The Cosmic Blueprint: New Discoveries in Nature's Creative Ability To Order the Universe. New York: Simon and Schuster. 203.

[2] Hoyle, Fred. 1982. The Universe: Past and Present Reflections. *Annual Review of Astronomy and Astrophysics*: 20:16.

[3] Atkins, Peter. 1994. *Creation Revisited*. Harmondsworth: Penguin. 143.

[4] Lennox, John C. 2009. *God's Undertaker: Has Science Buried God?* Oxford: Lion. 69.

[5] Davies, Paul. 2005. *The Mind of God*. New York: Simon & Schuster. 169.

[6] 'The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe. Why does the universe go to all the bother of existing? Is the unified theory so compelling that it brings about its own existence? Or does it need a Creator, and, if so, does he have any other effect on the universe?' (Hawking, Stephen. 1998. *A Brief History of Time, From the Big Bang to Black Holes*. London: Bantam. 174)

'There is no need to invoke anything supernatural in the origins of the universe or of life. I have never liked the idea of divine tinkering: for me it is much more inspiring to believe that a set of mathematical laws can be so clever as to bring all these things into being.' Paul Davies reported by Cookson, Clive. 1995. Scientists Who Glimpsed God. *Financial Times*, April 29, p.20.

[7] Lennox, John C. 2009. *God's Undertaker: Has Science Buried God?* Oxford: Lion. 65-66.

Lennox is a British mathematician and philosopher of science who is Professor of Mathematics at the University of Oxford.

[8] Leslie, John. 1989. *Universes*. London: Routledge. 14.

(part 7 of 8): Multiple Universes

First, it is important to know what is naturalism. Naturalism is the*belief* that only natural explanations (as opposed to *super*natural ones) should be considered. Because a designer/Creator is *super*natural and beyond nature, naturalism rules out this explanation, *regardless* of evidence.

Therefore, due to the fact that *no* natural explanation has been found for fine-tuning, some physicists make recourse to a multiverse (multiple universes) - a naturalistic explanation.

The idea is that if there exists a vast multiverse, the probabilistic resources available to account for our finely tuned universe by chance are increased. Therefore, many atheist scientists have come to the conclusion that fine-tuning*needs* explanation *unless* many worlds are assumed.

According to this idea, there are an enormous number of universes with different initial conditions, values of constants, and even laws of physics. Our universe is just one member of this 'multiverse' out of (probably) an infinite random universes. If all these other worlds really exist, then, by chance, life-permitting universes will have observers in them and they will observe their world to be finely tuned.

Therefore, there is no need to say our universe was fine tuned for life, that is, the laws, constants, and initial conditions were precisely set to allow life.

Thus, simply by chance, some universe will have the 'winning combination' for life. It is just like you produce lottery tickets. Even if it is 1 in a 10 million chance, the winning ticket will eventually come up. According to this idea, human beings are winners of a 'cosmic lottery.' When it comes up, humans evolve and look back and say, 'we were lucky!'

Some Observations On Multiple Universes (Multiverse Hypothesis)

First consideration: There is no shred of evidence to prove the existence of these multiple universes. As a matter of principle, we cannot even observe them.[1] That is why the idea has been severely criticized by leading scientists:

John Polkinghorne of Cambridge, a former professor of mathematical physics, has called the idea "pseudo-science" and "a metaphysical guess."[2]

In another place, he had this to say, 'The many universes account is sometimes presented as if it were purely scientific, but in fact a sufficient portfolio of different universes could only be generated by speculative processes that go well beyond what sober science can honestly endorse."[3]

Arno Penzias, an American physicist and Nobel prize winner who co-discovered the cosmic microwave background radiation which helped establish the Big Bang theory, put the argument this way, 'Some people are uncomfortable with the purposefully created world. To come up with things that contradict purpose, they tend to speculate about things they haven't seen.'[4]

Martin Rees is a British cosmologist and astrophysicist from Cambridge and past President of the Royal Society. In a 2000 interview with a science

journalist, he admitted the calculations are "highly arbitrary", and that the theory itself "hangs on assumptions," remains speculative, and is not amenable to direct investigation. 'The other universes are unavailable to us, just as the interior of a black hole is unavailable,' he said. He added that we cannot even know if the universes are finite or infinite in number.[5]

Richard Swisburne, a leading philosopher, comments, 'To postulate a trillion-trillion other universes, rather than one God, in order to explain the orderliness of our universe, seems the height of irrationality.'[6]

Second consideration: it violates the principle of Ockham's Razor which states that the most plausible explanation is one with the least number of assumptions and conditions.[7]

Third consideration: All known multiverse *theories* actually have significant fine-tuning requirements. Consequently, the fine-tuning of a "multiverse" will *need* an explanation. In order to be credible, a plausible mechanism must be suggested for the many worlds. Where did the "multiverse generator" come from? A 'multiverse generator' will require 'design.' It would need to be 'well built' with just the right laws and have the right ingredients (initial conditions) to function and produce life sustaining universes. For example, examining the inflationary superstring multiverse, it requires at least five special mechanisms or laws. Who or 'what' designed this hypothetical generator remains unanswered.

Therefore, the universe generator hypothesis does not undercut the fine-tuning argument, instead it kicks the issue of fine-tuning up one level.

Forth consideration: Since, a multiverse cannot be observed, how can anyone know that the other worlds are less ordered and more chaotic and fruitless than ours? If the only world we know and we can use as clue for the structure of others is the one we live in, and it is fine-tuned, then by analogy the other worlds must have been at least as well designed as this one. That would require even a *more* powerful Creator.[8]

Fifth consideration: Even though at the present time there is *no* scientific evidence that a multiverse exists, there does not seem a need to deny it's possibility.[9] Just like there are many dead planets in our universe, maybe, just maybe, there are many dead universes as well. Interestingly, there is actually an important theorem[10] which states that even if a multiverse that generated our universe existed, it *must* have a beginning! Consequently, it will best be explained by the design of a powerful Creator, not chance.

To sum it up, multiverse hypothesis is purely speculative. Even if it turns out to have any scientific merit, it is fully compatible with belief in God.

Universe or multiverse, fine-tuning wins. Heads or tails, Creator wins.

Footnotes:

[1] 1. "Originally the many-worlds hypothesis was proposed for strictly scientific reasons as a solution to the so-called quantum measurement problem in physics. Though its efficacy as an explanation within quantum physics remains controversial among physicists, its use there does have an empirical basis. More recently, however, it has been employed to serve as an alternate non-theistic explanation for the fine-tuning of the physical constants. This use of the [hypothesis] does seem to betray a metaphysical desperation." Michael J. Behe, William A. Dembski, and Stephen C. Meyer, *Science and Evidence for Design in the Universe*, 104, referencing Clifford Longley, "Focusing on Theism."

2. Yaran, Cafer. 2003. *Islamic Thought on the Existence of God*. Washington: The Council for Research in Values and Philosophy. 74.

[2] Polkinghorne, John 1995. *Serious Talk: Science and Religion in Dialogue.* London: Trinity Press International. 6.

[3] Polkinghorne, John. 1998. *Science and Theology*. Minneapolis: Fortress Press. 38.

[4] Brian, Denis. 1995. Genius talk: Conversations with Nobel Scientists and Other Luminaries. New York: Plenum Press. 164.

[5] Even so, he said the multiverse theory "genuinely lies within the province of science." Brad Lemley, "Why Is There Life?" In a subsequent interview, Rees said it's helpful for physicists to contemplate the possibility of other universes. He added: "I don't believe, but I think it's part of science to find out." See Overbye, Dennis 2002. A New View of Our Universe: Only One of Many. *New York Times*. October 29.

[6] Swisburne, Richard. 1995. *Is There a God?* Oxford: Oxford University Press. 68.

[7] Paul Davies, a theoretical physicist, wrote: "Another weakness of the anthropic argument is that it seems the very antithesis of Ockham's razor, according to which the most plausible of a possible set of explanations is that which contains the simplest ideas and least number of assumptions. To invoke an infinity of other universes just to explain one is surely carrying excess baggage to cosmic extremes…It is hard to see how such a purely theoretical construct can ever be used as an explanation, in the scientific sense, of a feature of nature. Of course, one might 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." (Davies, Paul. 1983. *God and the New Physics*. New York: Simon and Schuster. 173-174)

Also, see Yaran, Cafer. 2003. *Islamic Thought on the Existence of God*. Washington: The Council for Research in Values and Philosophy. 73.

[8] Yaran, Cafer. 2003. *Islamic Thought on the Existence of God*. Washington: The Council for Research in Values and Philosophy. 75.

[9] '…the holy texts are not alien to the concept of the worlds…first chapter of the Qur'an, which every practicing Muslim recites several times a day start with a few words that combine the concept of worlds with God: "Praise be to Allah the Cherisher and Sustainer of the Worlds.' It is interpreted as 'Allah cares for all the worlds He has created.'"

Yaran, Cafer. 2003. *Islamic Thought on the Existence of God*. Washington: The Council for Research in Values and Philosophy. 75-76.

[10] Known as the Border-Guth-Vilenkin (BGV) theorem.

(part 8 of 8): Wrap-Up of Fine-Tuning of the Universe

1. After exhausting all possible mutually exhaustive causative explanations, fine-tuning of our universe is *best* explained to be the "design" of an immensely knowledgeable and powerful Creator. Divine creation, *not* chance, is the *most compelling* and *reasonable* explanation for the fine-tuning of the universe.

2. Multiverse hypothesis is highly speculative, but even if true, it would *not*conflict with belief in God.

3. The reason that evidence from fine-tuning is extremely compelling and reasonable, but *not* definitive is that science is *limited* by it's nature. To be more precise, all scientific endeavor is limited *by definition*. Obviously, what we can learn from science will also be limited at a certain level. To understand this statement, we need to know that there are two generally accepted, major types of reasoning: induction and deduction. *Science* is based on *induction*, *mathematics* is based on *deduction*.[1] *By definition*, inductive reasoning is *uncertain*. The well known 'problem of induction' led the thinker Charlie Broad to say, 'induction is the glory of science and the scandal of philosophy.'[2] Thus, science cannot *deductively prove* God because science is an empirical endeavor based on *induction*. Furthermore, science by itself*cannot* be certain that it has considered all possible data for a complete explanation of a particular phenomena, let alone the universe itself.

But, science *does* enable us to identify the exceedingly *highimprobability* of a random occurrence required for life to exist in the universe.

4. That is why when we describe fine-tuning evidence as *compelling*, we don't mean that *everyone* will be convinced by our explanation of every bit of evidence, or that we have made such a definitive and irrefutable case for the evidence that no one will be able to resist the conclusions. The evidence is compelling in and of itself, but our articulation of that evidence will only be as good as our grasp of it.

On the other hand, if someone does *not* want to believe in God, no amount of evidence can force such a person to accept God's existence as fact.

5. Finally, we need *not* depend on science, complex logic, or a high level of education to 'see' the evidence for the Creator. The creation points to its Creator. This knowledge has always been available to human beings regardless of their level of education. After all, an illiterate man has as much

right to know God as modern-day scientists and philosophers. To think otherwise, is the height of arrogance.

Following are reflections of an Arabic poet, and conclusions of a modern-day theologian and some notable physicists. They show that knowledge of God's existence has been equally and easily accessible to those who choose to 'see' God in their immediate environments:

Arabic poet, 'Camel dung indicates the presence of a camel and footsteps indicate that someone walked here. So the heavens with their stars and the earth with its mountains and valleys must indicate the existence of the "All-Knowing," the "All-Aware" (two Names of God).'[3]

Keith Ward said, 'There may be no proofs of God in physics. But it is no longer true that physics has rendered God superfluous. On the contrary, it is the strongest indicator that our physical world is founded on universal principles so elegant and beautiful, so ordered and interrelated, that it suggests to the mind with almost overwhelming force that the basis of this world is one rational and conscious Creator, who has imprinted in the heavens and on the earth the manifest marks of His handiwork.'[4]

John Polkinghorne commented, 'When you realize that the laws of nature must be incredibly finely tuned to produce the universe we see, that conspires to plant the idea that the universe did not just happen, but that there must be a purpose behind it.'[5]

Allan Sandage who determined the accurate value for the Hubble constant, the age of the universe, and also discovered the first quasar, wrote, 'I find it quite improbable that such order came out of chaos. There has to be some organizing principle. God to me is a mystery, but is the explanation for the miracle of existence, why there is something instead of nothing.'[6]

Vera Kistiakowski, professor of physics at Massachusetts Institute of Technology, summarized the implications of the evidence,

'The exquisite order displayed by our scientific understanding of the physical world calls for the divine.'[7]

Footnotes:

[1] Tarski, Alfred. 1994. Introduction to Logic and to the Methodology of the Deductive Sciences. New York: Oxford University Press. 112.

[2] Broad, C.D. 1926. The philosophy of Francis Bacon: An address delivered at Cambridge on the occasion of the Bacon tercentenary. Cambridge: University Press, p. 67.

[3] 1. al-Ashqar, Dr. Umar. 2005. *Belief in Allah*. Riyadh: International Islamic Publishing House. 120.

2. Wazir, Muhammad Ibn Ibrahim. 1930. *"Tarjih Asalib al-Quran 'Ala Asalib al-Yunan*. Cairo: Matba'a al-Ma'ahid bi-Misr. p. 83.

[4] Ward, Keith. 1986. *The Turn of the Tide: Christian Belief in Britain Today*. London: BBC Publications. 57.

[5] Polkinghorne, John. 1998. Science Finds God. *Newsweek*, 20 July.

[6] Dr. Allan Sandage quoted by Wilford, John Noble. 1991. Sizing Up the Cosmos: An Astronomer's Quest. *New York Times*. 12 March, B9.

On-line. Available from Internet, http://www.nytimes.com/1991/03/12/science/sizing-up-the-cosmos-an-astronomer-s-quest.html?src=pm&pagewanted=3, accessed 10 Mar 2014.

[7] Kistiakowsky, Vera. 1992. The Exquisite Order of the Physical World Calls for the Divine.*Cosmos, Bios, Theos*, ed. Roy Abraham Varghese. Chicago: Open Court. 52.