

## THE PHYSICS AND METAPHYSICS OF MULTIPLE UNIVERSES (9/26/2014)

Neil A. Manson  
Department of Philosophy and Religion  
The University of Mississippi  
[namanson@olemiss.edu](mailto:namanson@olemiss.edu)

### I. One Example of a Fine-tuned Free Physical Parameter

<i>parameter</i>	<i>actual value</i>
$M_n$ (mass of the neutron)	939.57 MeV
$M_p$ (mass of the proton)	938.28 MeV
$M_n/M_p$ (the neutron/proton mass ratio)	1.001375

If  $M_n$  had been 941, so that were  $M_n/M_p$  had been 1.003, there would be no stars, and therefore no heavy elements, and therefore no life anywhere in the universe. Note that  $M_n/M_p$  is a dimensionless parameter – any physicist anywhere in the universe would come up with the same ratio, regardless of the unit of measure for mass.

### II. How to Visualize Fine-Tuning: The Range Game

<u>The Range Game (<i>The Price Is Right</i>)</u> <i>possible car prices</i>		<u>Fine-tuning for Life of <math>M_n/M_p</math></u> <i>possible values for <math>M_n/M_p</math></i>	
↑		↑	
\$25,000		1.004	
\$24,000		1.003	life-permitting window
		.004	
\$23,000		1.002	
actual car price	x	actual value	x
\$22,000		1.001	1.001375
\$21,000		1.000	
\$1000	winning window	.	
\$20,000		0.999	
↓		↓	

### III. Stating the Fine-Tuning Design Argument Formally

#### Premise Constituents

K = Many of the initial conditions and free parameters of a universe need to be just right (“fine-tuned”) in order for the development of life in that universe to be possible.

E = Life is possible in our universe.

D = A supernatural designer of immense power and knowledge exists.

MU = There exist many other universes, with varying initial conditions and values for the free parameters.

E' = Some universe or other is fine-tuned for life.

The Fine-Tuning Design Argument (full Bayesian version)

(1)  $P(E|K \ \& \ \sim D) \approx 0$

{ **translation:** The probability that life is possible in our universe, *given that* life requires cosmic fine-tuning and there is no Designer, is virtually zero. }

(2)  $P(E|K \ \& \ D) \gg 0$

{ **translation:** The probability that life is possible in our universe, *given that* life requires fine-tuning and there is a Designer, is quite high. }

(3)  $P(D|K) \gg P(E|K \ \& \ \sim D)$

{ **translation:** The probability that a Designer exists is much greater than the probability that life is possible in our universe *given that* life requires fine-tuning and there is not a Designer. }

So, (4)  $P(D|E \ \& \ K) \gg 0$

{ **translation:** The probability that a Designer exists, *given that* life is possible in our universe and life requires fine-tuning, is very high. }

**IV: A Helpful Analogy to the Fine-Tuning Design Argument: The Poker Cheat Argument**

(1) The probability that Manson deals himself three straight royal flushes, *given that* there is only one chance in 649,740 of getting a royal flush in a single fair deal and Manson is not a skilled poker cheater, is virtually zero.

(2) The probability that Manson deals himself three straight royal flushes, *given that* there is only one chance in 649,740 of getting a royal flush in a single fair deal and Manson is a skilled poker cheater, is quite high.

(3) The probability that Manson is a skilled poker cheater is much greater than the probability that Manson deals himself three straight royal flushes, *given that* there is only one chance in 649,740 of getting a royal flush in a single fair deal and Manson is not a skilled poker cheater.

So, (4) *given that* Manson deals himself three straight royal flushes and there is only one chance in 649,740 of getting a royal flush in a single fair deal, the probability that he is a skilled poker cheater is very high.

**V: The Multiverse Response to the Fine-Tuning Design Argument**

The Multiverse Hypothesis “screens off” the probabilistic support D lends to E. That is, if we suppose there are many other universes, the first premise of the Fine-Tuning Design Argument is no longer true; E no longer favors D over  $\sim D$ . Instead,

(5)  $P(E|K \ \& \ \sim D \ \& \ MU) = P(E|K \ \& \ D \ \& \ MU)$

{ **translation:** The probability that life is possible in our universe, *given that* life requires fine-tuning, there *is not* a Designer, and there is a multiverse, is approximately equal to the probability that the universe is fine-tuned for life, *given that* life requires fine-tuning, there *is* a Designer, and there is a multiverse. }

**VI: A Helpful Analogy to the Multiverse Response to the Fine-Tuning Design Argument: The Multi-Deal Response to the Poker Cheat Argument**

If Manson has dealt quadrillions of poker hands, the probability goes up that some sequence within the quadrillions includes three straight royal flushes.

**VII: The ‘This Universe’ Objection to the Multiverse Response to the Fine-Tuning Design Argument (Roger White)**

Suppose that 1% of all possible universes are life-permitting, that according to MU there are exactly 1,000 universes, and that there is no Designer. Then

$$(6) P(E|\sim D \ \& \ \sim MU \ \& \ K) = 1\%$$

{ **translation:** The probability that this universe we’re in is fine-tuned for life, *given that* there isn’t a Designer, there is only one universe, and 1% of possible universe are life-permitting, is 1%. } But conditionalizing on the multiverse hypothesis doesn’t change anything, says White.

$$(7) P(E|\sim D \ \& \ MU \ \& \ K) = 1\%$$

{ **translation:** The probability that this universe we’re in is fine-tuned for life, *given that* there isn’t a designer, there are 1000 universes, and 1% of possible universe are life-permitting, is still 1% (because the existence of 999 other universes doesn’t make it any more likely that this one is fine-tuned). } It’s just not relevant that

$$(8) P(E|\sim D \ \& \ MU \ \& \ K) = 1 - P(\sim E|\sim D \ \& \ MU \ \& \ K) = 1 - (0.99)^{1000} = 99.99\%$$

{ **translation:** The probability that some universe or other is fine-tuned for life, *given that* there isn’t a Designer, there are 1000 universes, and 1% of possible universe are life-permitting, is well over 99%. }

This illustrates that the equality expressed in (5) is false if we replace the left of (5) with the left of (8).

**VIII: A Helpful Analogy to the ‘This Universe’ Objection to the Multiverse Response to the Fine-Tuning Design Argument: The ‘This Game’ Objection to the Multi-Deal Response to the Poker Cheat Argument**

If you’re playing poker with Manson and he deals himself three straight royal flushes, his telling you that he’s dealt thousands of quadrillions of hands and that over that time he’s dealt himself three royal flushes in a row a bunch of times is not going to make you any less suspicious that he’s cheating now. It’s just not relevant that he’s dealt all those royal flushes on all those other occasions. You’ll still rightly be suspicious that he got three royal flushes in a row on this occasion.

**IX. Manson’s Two Criticisms of the ‘This Universe’ Objection to the Multiverse Response to the Fine-Tuning Design Argument: the ‘This Planet’ Objection and the ‘Essential Properties’ Objection**

(A) “Why is this universe fine-tuned?” is a bad question. I will give several analogies to support this claim.

First Analogy: suppose Neil deGrasse Tyson explains the fitness of the Earth for life by pointing to the recent discovery of a wealth of extra-solar planets. Given the vast number of galaxies in the universe, with each galaxy hosting a vast number of stars and each star orbited by quite a few planets, he claims that it is likely that somewhere or other in the universe there exists a planet with conditions that are just right for life to develop on it. He isn’t explaining why this planet is fit for life. Instead, he is changing the question to a more sensible one.

Second Analogy: On hearing news reports that a lone family in a remote Armenian village survived a devastating earthquake in December 1988 (nearly 50,000 Armenians were killed by that earthquake), a friend of mine said at the time "It's a miracle." When I noted that, given the size of the area, it wasn't unlikely that some family occupied a protected position in a fortified cellar at the time of the quake, she replied "Well, it's a miracle that *they* survived." When I retorted that this was (from her point of view) equivalent to saying "Well, it's a miracle that *the survivors* survived" and that there was nothing the least surprising about *that*, she called me a bad name. But I was right.

Third Analogy: Roy Cockrum of Tennessee won \$259,800,000 in Powerball on June 11, 2014. What's the explanation of that fact? Well, tens of millions of people bought tickets and the odds were some person would win eventually. Once announced, the winner gains notoriety for being a new multi-millionaire. Asking "Why was it Roy Cockrum of Tennessee who won Powerball?" is not a reasonable question. That's because there's nothing special about Roy Cockrum of Tennessee – nothing that picks him out for us – besides the fact that he won Powerball.

(B) White's objection rests on the metaphysical assumption that, according to the multiverse hypothesis, the values taken by the free parameters of a universe are not among its essential properties – that is, that this very universe could have taken a different set of values for its free parameters. White's objection just assumes that, for example, this very universe could have had a neutron/proton mass ratio three times what it actually is.

Alvin Plantinga says there is no reason to deny this: "there is certainly no reason at all to think that if there are many universes, they will have essentially the property of displaying the values, for those parameters, that they do in fact display" (*Where the Conflict Really Lies*, p. 218). The reason Plantinga gives, however, is pure armchair intuition (p. 217): "Aren't there possible worlds that are just like the actual world except the law of gravity isn't inversely proportional to  $r^2$ , but to  $r^{2.0\dots\dots01}$ ? Isn't it possible in the broadly logical sense that you and I (more exactly, our bodies) should have existed even if the law of gravity had been different in that minute way? It certainly seems so."

My response: the physicists who have developed multiverse theories are saying there is a hitherto-unknown natural kind: universes. If philosophers want to speak in an informed way about the properties of this new natural kind (rather than just opine from their armchairs), they really should ask the physicists. Here is an analogy: if you are asked to judge whether an human embryo is a human life, you really should come to know the science regarding embryos, fetal development, and so on. Of course, that information might not settle the issue of when human life begins (you might need additional philosophical principles to do that). But you need to know the science regarding embryos, fetal development, and so on to make an informed judgment. Likewise for universes.

Alas, the physicists don't have a lot of time for metaphysics. They have simply not addressed the metaphysical issue of the essential and accidental properties of this new natural kind. Maybe that is because no one has ever asked them. That is why I am making a foray into "experimental philosophy." I am distributing to over a hundred cosmologists a survey to uncover their views on the metaphysics of multiple universes.

## **X. Manson's Survey of Cosmologists on Fine-tuning and the Multiverse: A Preview**