

The Design of the Cosmos

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A while ago, I had the pleasure of being called to reserve duty on a remote outpost in the Negev. In anticipation of the complete lack of stimulating intellectual activity there, I gathered a number of books to pass the time. One was a book that a friend had given me, called *The Life of the Cosmos*. The author, Lee Smolin from Penn State, is a high priest of an esoteric branch of physics called cosmology, the science that studies the birth of the universe. The book presents Smolin's ideas about how and why the universe got to be the way it is. The problem he addresses is that our universe is particularly well suited for hosting life - as if it were designed specifically for that - and such a conception is not compatible with a completely naturalistic worldview, i.e. that random chemical and physical processes alone can account for the world that we live in.

The argument from design was for a long time one of the most compelling reasons for belief in God. It was presented in perhaps its most eloquent version by the Reverend William Paley in the early nineteenth century, in his parable of the watchmaker. Imagine that one finds a watch on the ground:

when we come to inspect the watch, we perceive. . . that its several parts are framed and put together for a purpose, e.g. that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; that if the different parts had been differently shaped from what they are, or placed after any other manner or in any other order than that in which they are placed, either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it... the inference we think is inevitable, that the watch must have had a maker - that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer, who comprehended its construction and designed its use...

The analogy to the structure of the world is obvious.

The marks of design are too strong to be got over. Design must have had a designer. That designer must have been a person. That person is GOD.

This argument was dealt a death-blow by Darwin when he suggested that the order and apparent design that we find in nature could have come about as a result of organisms competing for limited resources. Individuals (with their natural differences in talents and characteristics) better suited to deal with their particular environment would have an advantage and be the most likely to reproduce, and their offspring will be similar to them. This mechanism alone is sufficient to explain the apparent design of organisms so perfectly suited for their surroundings and lifestyles. Natural selection is what Richard Dawkins termed "a blind watchmaker." As biologists garnered more proof for Darwin's theory of evolution with the understanding of genetics and molecular biology, the idea of design without a designer gained more credence.

In the 1970's, however, the argument from design was resuscitated, and by an unlikely discipline - the seemingly most natural and impersonal of the natural sciences - namely physics. Scientists began to notice that the natural laws seemed to be "tuned" to allow for the possibility of life. From the physics of stars to the chemistry of water, seemingly arbitrary parameters appeared to have been delicately set at the values most appropriate for complex carbon based lifeforms to exist in the universe. In other words, in order for life (as we know it) to exist, not just any

amalgamation of physical laws will do; the universe in which we find ourselves seems to have been tailor made to fit us. The details of this concept were collected in a 1986 book by Barrow and Tipler, (an astrophysicist and a mathematician) called *The Anthropic Cosmological Principle*.

Smolin begins his *Life of the Cosmos* with a review of the state of modern physics and comes to a conclusion identical to that of the Anthropic Principle. The currently accepted theory that describes the nature of matter and energy is called the standard model, more colorfully known as quantum chromodynamics. It is extremely successful at describing the most fundamental properties of the universe and has been verified experimentally to an outstanding degree. The equations used in this theory are based on certain physical constants that are measured. There is nothing intrinsic within the equations themselves that fixes these parameters. Once scientists do their experiments, collect the data, and empirically determine the values of these unknowns, the equations can be used to predict the outcome of future experiments, and thus the theories are tested and corroborated.

As an analogy, imagine that I wanted to mathematically describe a line on a piece of paper. The equation for a line is $y=mx+b$, but which line does that portray? Where is it on the page? Is it steep or flat? By setting the parameters m and b to real values, I determine the position and orientation thus selecting from the infinite possible lines the one unique line that corresponds to what is drawn on the paper. So too, the standard model describes an infinite set of universes. As we fix the unknown variables to actual numbers (e.g. the charge on an electron is set to the measured value of $-1.6021892 \times 10^{-19}$ Coulombs) we narrow down that set of possible universes to a description of one particular universe, namely ours.

Smolin notes that the values of the twenty or so free parameters employed by the standard model are not arbitrary, but appear to be extremely fine tuned to create a universe in which life can exist. He concludes the first part of his book by remarking that “the parameters must be chosen to an accuracy of one part in 10^{229} [a one followed by 229 zeros!] if the world is to have stars.” Clearly, the likelihood of that happening by purely random processes is extremely small, and the fact that our universe is built precisely that way begs explanation.

The upshot of this observation is that the precise tweaking of the fundamental parameters of quantum chromodynamics points alluringly towards the Reverend Paley’s designer. Smolin suggests an interesting alternative possibility for how these parameters could have become so finely tuned, one that does not require an intelligent designer. His ideas parallel Darwin’s in the sense that there is random variation and individuals best suited for reproduction are selected. In the case of the universe, though, the competing individuals are black holes. Each black hole creates a universe where the free fundamental parameters of the physical laws are slightly different from those of the parent universe. Universes that tend to favor black hole creation will succeed in parenting the most offspring universes, so natural selection will lead to an overwhelming number of universes in which the parameters are most finely tuned to maximize the formation of black holes. Coincidentally, the tuning of the universe to maximize black hole creation, posits Smolin, just happens to maximize the potential for life as well, and that is why all those parameters seem to be tuned to the values that allow for life.

I am certainly not capable of assessing the merits or drawbacks of Smolin’s theory from a physical or mathematical standpoint. Smolin himself realizes that many of the tests that could corroborate or falsify his theory are beyond the limits of modern technology, so his ideas are largely speculative. The core contention of his presentation, though, is still extremely convincing: the design apparent in the structure of the universe is indisputable and cannot be dismissed. Either

one must assume some sort of natural mechanism that can effect “self-organization” and tune itself (analogous to natural selection tuning organisms to their environments), or one must admit an external source for the world's design, i.e. God.

These two alternatives are fundamentally different from one another. The day that I finished reading *The Life of the Cosmos* in that army base happened to be *Rosh Chodesh*, when Psalm 104 is appended to the morning prayer. That chapter presents the Bible's perspective on the design of the universe:

He laid the foundations of the earth that it not be removed forever... Thou didst set a bound that they might not pass over; that they [the seas] might not turn back to cover the earth... The high hills are a refuge for the wild goats; and the rocks for the badgers... O Lord, how manifold are thy works! In wisdom hast thou made them all; the earth is full of thy creatures.

The poem ends, though, with a seemingly irrelevant and incongruous thought. “The sinners will be consumed out of the earth and the wicked will be no more. Bless thou the Lord, O my soul. Halleluya!” What does the elimination of sinners – which presumes morality and ethics – have to do with the design of the physical universe? I believe that the Psalmist, with acute insight, has hit upon the crucial and essential idea that qualitatively separates the notion of a naturalistic explanation for the world's design from a theistic interpretation. If the universe is the product of apathetic forces at play in a random fashion, then it is meaningless and absurd to speak of moral purpose or responsibility. If, on the other hand, the cosmos was designed *by* someone, then it was intended *for* something. Design by God implies morality. The intricate and complex tuning of the world's parameters that made life possible was done for a purpose. The existence of man is not just an accidental byproduct of black hole formation; our presence in the universe is imbued with meaning. We have an obligation to abet and promote the objective of Creation, and to carry the design one step further - namely to utilize the natural potential of the world for its proper intention, to eradicate evil and work towards harmony and peace between people.

In considering these two opposing worldviews, I have a few comments to make. First of all, (other than for a handful of cosmologists), the details of Smolin's hypothesis are beyond the ability of most people to assess. Without the skills to properly evaluate the theory, one who subscribes to it is doing so on faith, on faith that the scientist's work is sound, that the universe actually works that way (though the experimental evidence is lacking), or that some other natural mechanism exists that can explain the fine tuning of the universe. It seems to me that this faith is no less irrational than belief in God, and it would do well for detractors of religion to keep this in mind when peremptorily dismissing those who choose to believe in God as unthinking troglodytes still living in the intellectual middle ages.

Furthermore, without solid and incontrovertible proof for either hypothesis, we are free to choose between the two alternative worldviews. Ultimately, the choices that we make in our lives are not made in a vacuum; we do not solely weigh intellectual options, but rather factor in utilitarian concerns, emotions and aesthetics as well. It would appear to me that on that level, when weighing a completely naturalistic view of the world against a religious one, the scales are tipped in favor of the latter. Personally, I would choose to live in a world full of meaning and purpose, where the notions of right and wrong make sense, and where I and my children can work towards a better world and bring the design of the universe a bit closer to perfection.