

Accident or Design

Taeil A. Bai

Stanford University, Stanford, CA 94305

In a companion article it is shown that, if the value of any of the fundamental physical constants were even slightly different from its actual value, the universe would not be able to generate life. A universe may exist that has the same set of natural laws as ours but fundamental constants with different values. Many scientists find no logical reason to deny such a possibility. But such a universe, if it exists, would be barren. (Several books have been written on this subject.[1,2]) Considering that life is a phenomenon emerging at a scale far removed from the subatomic scale and the cosmological scale, the fact that the values of fundamental constants and the cosmological characteristics of our universe are precisely those needed to allow the emergence of life is so unlikely to be due to chance and so awesome that it begs an explanation. John Wheeler said that the universe seemed to be adapted for humanity:[3]

It is not only that man is adapted to the universe. The universe is adapted to man. Imagine a universe in which one or another of the fundamental dimensionless constants of physics is altered by a few percent one way or the other. Man could never come into being in such a universe. That is the central point of the anthropic principle. According to this principle, a life-giving factor lies at the center of the whole machinery and design of the world.

Here we find the word “design,” which has been expelled from biological scholarship by the biologists. Here we also find the word “anthropic,” which means “related to human beings” or “related to the existence of human beings.” The anthropic principle posits that the existence of human beings provides a clue to the understanding of the properties of our environment. We can answer many questions regarding the properties of the earth and the solar system by using the anthropic principle. For example, we can answer the question “Why is the solar system so old?” The solar system should be old enough to allow the emergence of humans. If the solar system were not old, we would not be here to pose that question. Why is the climate on earth just right for human habitation? If the climate were not right for humans, we would not have evolved here. We can use the anthropic principle in the cosmic context. The question “Why is the universe very old?” is explained by our existence. It takes a long time for intelligent life to emerge because long evolutionary processes—cosmic evolution, stellar evolution, chemical evolution, and biological evolution—are prerequisites for the emergence of intelligent life in the universe. The anthropic principle used in the above examples is called the *weak anthropic principle*.

If we apply the weak anthropic principle to the question “Why is the universe fine-tuned for life?” we get the following answer, which is not satisfactory. We would not be here to pose the question, if it were otherwise. The anthropic principle was first used in the cosmological context by

Brandon Carter.[4] According to him, we need a *strong anthropic principle*, which can be stated: “The universe must be such as to admit the creation of observers within it at some stage.” Unlike the weak anthropic principle, the strong anthropic principle claims that the existence of the universe is contingent upon the existence of *intelligent observers*.

There are three ways to interpret the fine-tuning of fundamental constants. First, they were fine-tuned by an omniscient God. Second, there exist a very large number of universes with different values of fundamental constants, and we are here because this universe *happens to be* suitable for the development of intelligent life. Third, there must be fundamental laws which would show that the fundamental constants, which seem to be independent, are actually interrelated and have their observed values by logical necessity. Let us discuss these one by one.

According to the first interpretation, at the time of the creation, the omniscient God chose the values of the fundamental physical constants with such foresight that the emergence of intelligent life was possible. The argument that the whole universe has been designed is fundamentally different from the old design argument, which posits that living organisms and their organs were designed by the Creator. The old design argument was refuted by the discovery that natural selection can mimic apparent design in organisms.

As an alternative to the existence of design in the creation of the universe, one can assume that our universe is just one of universes that are suitable for life among a large number of universes. There are three variations of the many-universe interpretation. The first is that there are many parallel universes, each being separate and independent from the others. The second is that there are many sequential universes. In the cyclic-universe hypothesis of John Wheeler, a new set of physical laws and a new set of physical constants are chosen randomly at each big bang. The third variation is that there are many domains in the huge universe, and fundamental constants may vary from one domain to another. We cannot detect other domains, because they are much farther away than 14 billion light years.[5]

Some theorists who propose many-universe interpretations interpret the strong anthropic principle as follows: Many universes come into existence by themselves, with all kinds of physical laws and various combinations of values of physical constants. (Here the present tense is used because we cannot establish temporal order among different universes.) Almost all of them are barren, being unable to produce life. But a few of them are suitable for the development of life. Only those universes that, during their lifetimes, produce intelligent observers that can ponder the mystery of their own universe attain the status of real existence. Our universe is obviously one of them. The universes that do not produce intelligent observers do not really exist because there is no one to recognize their existence. (Proponents of this argument are atheists. Therefore, there is no God who can observe and recognize these barren universes.) Because intelligent beings in the universe are formed from the matter within it, they are a part of it. Therefore, the cognition of the universe by its intelligent inhabitants is self-cognition by the universe. Reminding ourselves of Descartes’s famous phrase “I think; therefore, I am,” we can imagine the universe thinking, “I self-cognize;

therefore, I am.”

Some scientists are more willing to accept the existence of a large number of universes than the existence of God because they want to go as far as possible without invoking God. Can the many-universe interpretations be a firm basis for atheism? According to Ian Barbour,[6] the atheistic interpretation of the many-universe hypothesis relies on the interpretation of chance as antithetical to providence. However, according to Charles Hartshorne[7], chance is not antithetical to providence but is God’s way of fully exploring the potential of the universe (or universes). One may reason that the God who creates a very large number of universes in order to get a few habitable universes is not very powerful. But isn’t the ability to create a large number of universes as powerful as, if not more powerful than, the ability to create one and only habitable universe? One may regard creating a very large number of universes to get a few habitable universes as wasteful. However, is it not more wasteful, if God has abilities He does not use?

In selecting between God’s design and the many universes theory, one may use the criterion of Ockham’s razor. According to it, the simplest explanation that is compatible with the observed facts is the best one. Which is simpler: the existence of a large number of universes that can neither be detected nor proven or the existence of an omniscient God’s foresight and design in the creation of our universe? Many people, including me, think that God’s omniscience is a simpler explanation than the hypothesis of a large number of universes.[8,9]

Let us consider the third interpretation: fundamental constants are interrelated such that they have the observed values. It is also a speculative line of thought, because we have not yet found such relations. I personally imagine it plausible that some of the fundamental constants may turn out to be interconnected, but it is unlikely that all of them are so. But even if this interpretation proves true, it is all the more awesome that such fundamental natural laws and a universe obeying them came into being.

Scientists who propose many parallel universes rely on the hypothetical existence of hyperspace-time continuum within which quantum mechanical laws govern the generation of many universes. Quantum mechanics is applicable within the space-time continuum of our universe. It is doubtful whether the hyperspace-time continuum exists and whether we can extrapolate quantum mechanical principles to it. The scientists who subscribe to the third interpretation also rely on the existence of natural laws. Can natural laws be a substitute for God? Natural laws are expressible by equations, which is an amazing fact. Who devised these equations? The mere existence of such equations does not ordain the existence of a universe obeying them. Borrowing Stephen Hawking’s expression,[10] we may ask, “Who breathed fire into these equations?”

It is interesting to note here that, after the Copernican revolution, the status of human beings in the universe became increasingly less significant. First, the earth was dethroned from the center of the universe. Then, the sun was found to be in the outskirts of the Milky Way Galaxy instead of at its center. The world we live in has turned out to be a small planet circling around an ordinary star, which is one of hundreds of billions of stars in the Milky Way Galaxy. The Milky Way has also

turned out to be one of billions and billions of galaxies in the universe, which could be infinitely large. As the scope of the observable universe has increased, our significance in its vastness has decreased relatively. But now, as we consider the anthropic principle, the existence of human beings suddenly takes the center stage again: If we accept the hypothesis of a large number of universes, intelligent observers (human beings in our case) are the ones who establish the real existence of the universe, by recognizing it. If we accept an omniscient God, He designed and created the universe in order to make the development of intelligent creatures possible.

The recent discovery that fundamental constants of the universe are fine-tuned for life does not provide a conclusive evidence for the existence of God. However, it has made discussions on God go to much deeper levels. It also makes the existence of humans in the universe all the more important.*

Notes and References

1. Davies, P. C. W. *The Accidental Universe*. London: Cambridge University Press, 1982.
2. Rees, M. *Just Six Numbers*, New York: Basic Books, 2000.
3. Wheeler, J. A., “Foreword” in J. D. Barrow and F. J. Tipler. *The Anthropic Cosmic Principle*. New York: Oxford University Press, 1986.
4. Carter, B., in M. S. Longair, ed. *The Confrontation of Cosmological Theories with Observation*, p. 291. Dodrecht: Reidel, 1974.
5. Linde, A. “The Self-Reproducing Inflationary Universe,” *Scientific American* **271**, pp. 48–55, Nov. 1994.
6. Barbour, I. *Religion in an Age of Science*, p. 138. London: SCM Press, 1990.
7. Harshorne, C. *Divine Relativity*, p. 137. New Haven: Yale Univ. Press, 1948.
8. Swinburne, R. “Argument from the Fine-Tuning of the Universe” in ed. J. Leslie, *Physical Cosmology and Philosophy*, p. 172. London: Macmillan, 1990.
9. Davies, P. *The Mind of God*, p. 190. New York: Simon & Schuster, 1990.
10. Hawking, S. W. *A Brief History of Time*, p. 174. New York: Bantam Books, 1988.

*This article is adapted from a section of the book entitled *The Creative Universe and the Creating God* being written by the author.