

Respected Prof. Khrapko,

Several months ago, my friend and colleague Zoran Anđelković wrote a piece of work entitled "The Anthropic Principle and the Theological Problem". The two of us had many fruitful talks on the subjects mentioned, especially the anthropic principle which I refuse to accept as having any value. However, the second part of his work, which he chose to adapt for the Odessa Summer School is much more intriguing. I would like to offer you my views on it.

The main conclusion in the work is rather simple but interesting: Theological arguments in cosmology have bigger logical value than any scientific one.

As for the very idea of God I can do nothing but agree with everything you wrote in "Does the Creator exist?" It should not be surprising that God explains everything so elegantly, simply because God was *designed* to do so! Each his feature is determined by our limits and his final form is the result of long-time polishing. The first inquisitive minds satisfied themselves by inventing spirits and demons. The spirits later evolved into gods, gods were sublimed into one God and he reached the contemporary form of Spinoza's God, Divine Figure or The Creator. Even though science smashed it into a shapeless and timeless idea God's purpose remained the same: to fill in what we don't know.

Nevertheless, the artificial character of god does not make Zoran's point worthless. The amazing thing I see in it can be formulated as follows:

The ideal proposed by the very essence of scientific methodology can only be satisfied by a divine creature.

If we agree that science and religion are two opposite approaches, and if we agree that logic is the very core of all science, we cannot help wondering how the ultimate goal of essential natural sciences such as physics and cosmology is – God!

One of the basic rules of logic states that the best system is the one with least postulates. Therefore, if we want to make cosmology and physics best systems we must find that one postulate. But however we may call that one postulate it will undoubtedly (especially in cosmology) be either some form of God or something similar to oneness of Eastern religions. The amazing thing is that the very scientific thinking and rules order us to consider God! Will this be the end of logic as we know it, or a joyful marriage of Science and Religion?

The only solution I see that escapes these destinies is a scientific system based on an **empirical** postulate. However, I cannot explain (prove) why that would be better than a theoretical Devine Figure.

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When you finished your lecture at Gamow's School I left the conference room with a pleasant feeling of fascination and that weird rush of disorientation, like being pushed into a new world. I immediately read the paper You gave us and I was finally able to understand what caused all the thrill. It was the very idea that it is possible to write off extraterrestrial civilizations using purely theoretical and logical scientific arguments. Further more, the argument is ever so simple and elegant that almost anyone can understand it: our existence

is odd enough – another miracle is too much to ask. We wouldn't normally expect to see even terrestrial life, but it is miraculously and undeniably here and there is no reason to be greedy and ask for another.

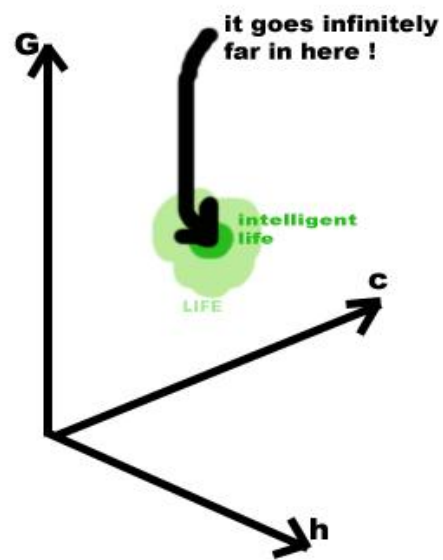
However, after numerous re-reading and close analyses of your work I got the impression that many arguments are not as solid as they seem to be. I will be grateful if you could help me by clarifying some points.

First of all, I would like to stress two points on which classical astrophysics is based:

1. **The universe is** (most probably, or at least practically) **infinite**
2. **The universe is** (at large scales) **homogenous**

This second point tells us that there should be no truly unique objects in our universe (e.g. all stars are similar, categorisable and equally spread) and the first one gives more than enough spacetime for completion of this homogeneity. In other words: the fundamental constants are (seem to be) the same in all the universe, the mass is almost equally divided, so life and civilization could just as well arise somewhere else! The fact that we can't see planets or suitable stars from here is of little value if we do not know the limits of our universe: it could just as well be that the universe is 50 times bigger than what we can see and that each of those 50 parts contains one civilization. The uniqueness of planet Earth in such a homogenous and vast universe is *improbable* or even impossible, if we consider classical physical laws.

Next, I would like to bring your attention to a similar problem. When you say that "the area of values of the constants permitting life is extremely small" you are using arbitrary criteria for determining the size. You seem to be ignoring the mathematical bases of physical laws and the fact that something (some constant) can be infinitesimally small just like it can be infinitely big. On the right is your ingenious graph that I cannot erase from my memory. I think you will agree that the set of possible values inside the anthropic area is infinite just like the set of values outside the area. I should ask some mathematician first, but I claim that those two sets have the same cardinal numbers. This seems to oppose the obvious conclusion that some narrow interval is less probable than a bigger one.



This brings us to my third, and last, principle question. If I say "Extreme fine tuning of constants is a *very unlikely* event and so it is *most probable* to observe a one-civilization universe" and someone asks me "By what criteria?" what am I to answer?

Are we allowed to use statistics at such large scales? If we repeat an experiment 100 times and a phenomenon appears only 2 times we can say 'that phenomenon is rare'. But how can we judge such phenomena as creation of the universe and development of civilized life? Not only that we cannot repeat them but we don't even know if they are repeatable! The only criterion we can use for judging if something is rare or not is our common sense. But science is the opposite of common sense; if we allowed our instincts to rule us we would still think the Earth is flat.

I have only two more (almost technical) questions about your work.

- When you say "The idea of existence of a Creator in the universe and mankind excludes the idea of search for other civilizations" you are making a serious mistake. I am not an expert on comparative religions but I am quite sure that main religions do allow for God to have created other life, too. The Tibetan Book of the Dead even explicitly describes other worlds.
- Why did you call this principle Alternative Anthropic Principle? I fail to see any similarities with other anthropic ideas apart from the subject: explanation of existence of civilization(s).

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Finally, I would like to ask You to help me to properly understand the Anthropic principle. I was acquainted with the principle(s) even before Zoran's work, but after reading it I was even more confused. My confusion can be expressed as follows: why does anyone see more than a redundant statement in the anthropic principle? Why did that statement deserve a name, books, papers like Zorans and even conferences such as the one you mentioned in your paper (held in Cambridge)?

Zoran's paper contains the following Carter's definition:

Anthropic Principle is the fact that what we can expect to observe must be limited by conditions necessary for presence of us as observers.

It also contains numerous alternative definitions as well as subtypes (weak, strong...), but it seems to me that they all just say:

We can't see something that draws the conclusion that we do not exist.

Do we need some principle to tell us that? This has been one of the basic tools of science for centuries! Of course we will discard a theory that predicts that the Sun is green! We are certain (thanks to Descartes) that we exist so we cannot observe something that claims that we do not exist.

One of the points I tried to show to Zoran was: why us? Why observers? We can take an arbitrary object from the present time and limit a theory to predict the exact one. We can take, for example, the Sun. If we have a theory that predicts the Sun with bigger mass, different spectrum, a sun with just a quark less than the one we have – it is wrong. We can take any complex system as a lacmus paper: a galaxy, an interstellar cloud, a bottle of Shoostof Vodka or a swarm of bees - they all need the same amount of fine tuning. Why use the anthropocentric or "observer-centric" principle, and why use the principle at all? I'm sure the science of Logic has this tautology somewhere and probably has a name for it, too.

One other idea is often mentioned together with the anthropic principle: the multiple universes theory.

After reading the passage on multiverse in your paper I was additionally confused (how can a theory give a result such as: "the small probability of our universe is of no importance to us" – that is a personal decision, not a scientific conclusion), so I will use my previous understanding of the meaning of multiverse theory here.

As I understood it, the story goes like this: "How come our universe is fine-tuned just in this manner, when it is not so probable? Well, there are many many universes of which each has its own combination of fundamental constants. Therefore, our combination was bound to show up in one of them i.e. it's not a strange thing. And why are we in it? Because we can't be anywhere else – no other universe has the appropriate conditions."

My primary objection to this theory (besides the "size" of the infinity of universes needed, using of probability, and the similarity to the theological, "turtle in the ocean" approach) is this:

If the universes are, by definition, separated from each other in every possible way how can we explain the contents of one universe by naming the (hypothetical) contents of another? This way, the existence of life in our universe is caused, linked to existence of variations of fundamental constants in other universes. Other universes cannot have any influence on ours, even by their very existence!

In the end, I would like to offer you a very simple "proof" against the anthropic principle. I constructed it during one feisty discussion with Zoran in Odessa. I succeeded in silencing him, and I wonder if it really works in general.

First, we agree that the world can be either indeterministic or deterministic. Next, we take the first case:

- **If the world is indeterministic** (Copenhagen interpretation of Quantum Mechanics) **then anything is possible.** It is possible for life to exist even if  $h=12.887$ . It just takes a large number of tunneling effects but that is *possible*. Therefore, we can observe something that doesn't imply life and life can exist in any of those universes. The anthropic principle is *wrong*.

Or

- **If the world is deterministic then conditions-for-life = life.** If there are conditions for something to occur then it *will* definitely occur. The fact that we exist contains in itself the fact that there were once conditions for us to begin existing. When I say "I exist" the fact of existing conditions goes without saying. This makes the anthropic principle a mere *pleonasm*.

Thank you for reading,  
Ivan M. Antić