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LONG FUTURES AND TYPE IV CIVILIZATIONS

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Abstract

The emergence of the physical eschatology in the last decades led to an opportunity to ask questions about the fate of our Universe from a cosmologist's point of view and to study mankind's possible future on a cosmological scale, while we can define some theoretical limits of a civilization's possible developments.

Keywords: physical eschatology, Kardashev civilizations, Type IV civilization, criticism of Anthropic Cosmological Principle, artificial and natural signs.

> "*Whether the details of my calculations turn out to be correct or not, I think I have shown that there are good scientific reasons for taking seriously the possibility that life and intelligence can succeed in molding this universe of ours to their own purposes.*"
>
> (Freeman Dyson: Time Without End: Physics and Biology in an Open Universe)

1. Introduction

We could imagine a physicist floating in his laboratory in the outer space, far from any celestial body. That physicist would never discover the gravitational force without the closeness of big masses like our planet, wrote Astronomer Royal Sir Martin Rees, and similarly, the existence of some unknown forces is also imaginable, whose effects are not detectable on the scale of our Planetary System – but they would play an important role either in the centers of galaxies or in cosmology [1].

Perhaps it is not a sweeping generalization to state that the change of the scale can result the change of some effects and problems (in some cases, at all). To give an example: one of the central problems of Mars' terraforming is to build self-sustainable ecosystems, while a terrestrial architect would not know the meaning of terraformation at all. But an environmentalist would not hesitate to point out, that an unplanned terraforming has started, when the first agrarian societies appeared ten thousand years ago, and it is not questionable now whether mankind's activities

are able to alter planetary environments [2]. Historically, Jules Verne, the well-known science fiction writer of the 19th century mentioned the possibility of the total reshaping of Earth for the first time in his 1889 novel 'Sans dessus dessous' (The Purchase of the North Pole): the members of Baltimore Gun Club tried to alter the axis of our planet in this story, but there was not a mind in that era to foresee the environmental problems of the next century.

On a higher level of 'mega scale engineering', it is said that we would become a Dyson civilization, which was described by the physicist Freeman Dyson, and which means that we can collect all the radiation radiated by our host star; we could start stellar husbandry; etc. [3].

And, on the level of a cosmic engineering (which is the final pace to change environment), we could try to break open a closed universe. It is within the odds that we would be able to change the topology of space-time in the remote future, to save our descendants from the frying in a collapsing universe. It would be a cosmic level activity.

It is indifferent from our point of view whether we live in a closed universe or in an open one, actually, but it has a full importance that 'it is impossible to calculate in detail the long-range future of the universe without including the effects of life and intelligence', as Dyson observed [4]. This means in my interpretation that we cannot exclude that the appearance of human beings (or more general: the appearance of intelligence) would have an impact on the fate of the entire Universe and could as efficiently modify it as physical laws could.

Strong Anthropic Principle (SAP) states that 'The Universe must have those properties which allow life to develop within it at some stage in its history', where life means intelligent life, and, opposite the Copernican concept, terrestrial life has a central role in the history of the Universe. It is said by the representatives of this kind of 'Design Argument', that the 'fine tuning' of physical parameters leads to the rise of humans, and it is impossible to regard it as a coincidence only [5]. The scientific writer James N. Gardner represents the most radical wing of this school stating that the emergence of life and intelligence is a result of a 'cosmic evolution', and our universe is as selfish as genes were in Richard Dawking's book.

Martin Rees and other well-known scientists praised Gardner's hypothesis called 'Selfish Biocosm' [6], but we could answer that any kind of Design Arguments are necessarily false, since we could argue using it either that life started accidentally or that it was a part of a cosmic plan. After all, this argumentation is based only on the fact that we are living (and intelligent) beings, who appeared in this World.

Cosmic engineering emphasizes the importance of intelligent races similarly to the SAP, but it interprets the problem from the other side. It does not argue for a Universe created for humans, it only argues for the importance of intelligent races, which would influence our Cosmos. Or they will not, since there is no guarantee for our (or for any intelligent being's) survival and success (opposite to American physicist Frank J. Tipler's opinion, which we will discuss later on).

2. From the Physical Eschatology to the Creation of a New Universe

Physical eschatology is to study the last ticks of our universe. As Dyson mentioned in his lecture, those scientists who did works on it, needed to feel shy still in the 70s, but this attitude has been changing gradually [4]. The idea of a kind of 'engineering' to affect the galactic scale appeared years before the first paper was published about the fate of the physical World: Russian astrophysicist Nikolai Kardashev created a scheme to classify advanced technical civilizations in 1964 and listed three kinds of them.

His classification based on the power consumption of societies:

- a Type I civilization would use all the energy of a whole planet;
- a Type II can tap the power sources of a planetary system and;
- a Type III civilization would be an owner of a galaxy's all resources.

(American astronomer Carl Sagan found out that the distance between the Kardashev Types was enormous, and because of this a finer gradation was needed, and he labelled us as a 0.7 Type civilization.) [7]

The curious part about this typology was that neither Kardashev nor his followers (nor Sagan) introduced a fourth category for those who can manage the energy of a whole universe, although it would be the ultimate possibility – theoretically, at all. They simply did not envision a civilization manipulating their environment on the highest possible scale.

Kardashev wanted to apply his taxonomy to find extraterrestrial civilizations, for example he concluded that an OZMA-like research program would be unlikely able to detect Type I activities. So he suggested searching for the signs of Type II or Type III civilizations [7]; and we could conclude that their existence would be as unobservable as the existence of a Type IV civilization. 'Any sufficiently advanced technology is indistinguishable from magic', wrote a science fiction author named Arthur C. CLARKE [8], and in connection with our problem, he was right.

Another Soviet astrophysicist, B. I. Panovkin underlined in an ignored lecture on the search for extraterrestrial civilizations in the early 1970s, that there was not a culture independent interpretation of any sign, and hoping to be able to crack an alien code, we also had to hope that the message was sent from an Earth-like planet – actually from a Second Earth, he said [9].

The explanation of it is self-evident.

The well-known Polish science fiction writer Stanislaw Lem described in his book 'His Master's Voice' an imagined situation five years before Panovkin's lecture, where an outsider should have to decide whether a sign had an artificial origin, or not. The sign was the sugar concentration of a man's urine, as the definition of artificial meant that the man had eaten sugar, as he had an agreement with his physician, that the higher level of it would be a sign for an action (say for a revolution). The natural origin of high sugar concentration meant that experimentee preferred sweeties to other foods, and it is obvious that without a knowledge on the origin of sugar we were not be able to answer the question – since there is no difference between the sugar molecules of natural or artificial origin [10].

For the same reason, we will not be able to observe a difference between an artificial sign beamed by an alien civilization and a result of a natural process – unless that civilization uses a logic which is very similar to ours (prime sequences, for example). This is why Panovkin mentioned a 'Second Earth' as a criteria to their observability [9], and this is why we can state that stellar husbandry is indistinguishable from natural processes. Therefore we never will observe either Type II or Type III or Type IV civilization's cosmic activites. Ad absurdum, when we reach the fourth level in Kardashev's extended taxonomy, we will not be able to detect any other Type IV civilization (unless, as we mentioned, they will be really similar to us), but we will regard the results of their activities to modify the universe as results of the effects of natural laws. We can describe a bizarre scenario, where the world is old enough to breed a lot of Type IV societies, but they are not able to detect the others.

The ultimate theoretical limit of cosmic engineering is to create new or baby universes, but it follows from the fact that – without a knowledge about its origin – we cannot distinguish between a natural and an artificial sign (or object), that we are not able to make a difference between a natural and a created universe.

So there is an opportunity to try to interpret it in the spirit of the Design Arguments' traditions, as it seems to be possible (or imaginable at least), that our cosmos was created to serve as a home for life by a Type IV civilization, and – because of it – 'fine tuning' phenomenon is indeed not an accident.

But as long as we are not able to distinguish between a natural and a created Cosmos, there is no reason to take a question on its origin.

3. Some Ultimate Questions

Cosmologist Lee Smolin wrote an article about the supposed state of his field in 2050, and he listed 'the seven most important open questions' of cosmology (how the galaxies formed; what was the Big bang, a question about the quantum theory of gravity, etc.). He supposed that people often asked the most fundamental questions fifty years before they found an answer, so it was possible to predict the central problems of a next generation of scientists [11]. But modifying a time scale – as we emphasized earlier – we have to change the questions which are considered as important, too, and from the point of view of cosmic engineering, the final problems are different from those Smolin enumerated.

Dyson wrote a feasible history of the next million years in his book on 'Imagined Worlds', and he concluded, that the grimiest battle of the next thousand years will be fighted about the possible interpretations of the meaning of being human. 'Our one species will become many' within the next millennia, he noted, and they will populate our Planetary System, and a sole, central authority will not be able to control or to take a census on them. It is possible that there will not exist any beings we would recognize as humans on a time-scale of ten thousand years, and before the end of the next million years, we will not only conquer and colonize the entire

Galaxy, but we will live in a world of isolated islands, where the distance between two colonies will be too enormous to allow any human time-scale communication. 'Cultures will rise and fall, between a telephone call and the reply.' Namely, argues Dyson, we will live in a Carroll Universe, named after Lewis Carroll, the English mathematician. His fairy tale 'Alice in Wonderland' has a strange topology, where 'It takes all the running you can do, just to stay in the same place.' [12]

Star Wars series described a totally different topology with real time travel across an entire galaxy. It is not our role to decide whether it was only a play of fancy or a next generation of physicists would be able to build space-time machines similar to Millennium Falcon, but this example helps us to show, that some parameters of our physical reality can limit our imaginable futures.

It is possible to picture a Star Wars-like universe where a Type IV civilization can use all power sources to convert matter into radiation to create an open universe instead of a closed one, but it is hard to believe that a superior civilization can co-ordinate all the needed tasks, when an answer has to travel a billion year. Do not mistake the colonization of space for the posses of every energy source or for building a 'pan galactic empire'. While Tipler demonstrated it technically feasible to engulf the entire universe before it will begin to contract (if it will at all), but nobody demonstrated the possibility of a Star Wars-style, all-embracing realm up to the present day, so it is possible that Kardashev was right to eliminate the opportunity of the creation of a Type IV civilization.

Tipler believed that life did not have a choice in the very long run in a Carroll topology: 'it must take the natural structures apart if it is to survive'. SAP meant by his interpretation that an intelligence had to exist when the Universe started to collapse, but it should have die out by that time in case it did not create an omnipotent civilization [13]. But – because of the inconsistency of the Design Arguments – it seems to be not acceptable as a scientific theory.

Besides controlling the entire Universe as a Type IV civilization, the other known solution to play God is to create baby Universes, and there is no connection (as far as we know now) between the topology of an universe and the opportunity to create a new one.

So we can draw a matrix about the all imaginable universes' 'intelligence-friend' features. We would prefer the variation, obviously, where we have an opportunity both to breed a Type IV civilization and to create new universes; and, opposite to it, we would not prefer the hostile combination, where neither the previous, nor the other one would be possible.

Regarding a very long future of humans, one of the ultimate questions is which version of that matrix can describe our world.

4. Toward a Historical Cosmology and a Very Large Scale Ethics

The (hypothetical) appearance of a Type IV civilization could result the change of the nature of natural sciences and especially the nature of cosmology. We can

envisage a very distant future, when modifying of the Universe's geometry becomes a 'political' question as a political question was to build a dam in the 20th century. And it is self-evident, that as soon as an intelligence can affect the fate of the Cosmos, we have to take into consideration this new parameter too, if we want to write the history of the World on a cosmological scale. So the cosmology would become a 'historical' science, more or less similarly to biology, for example – after all, we cannot be able to write the histories of species and especially those species, which was killed off by Earthlings today, without mentioning our role. Or we could mention our evolution, which will be modified by our will in the next decades in case the transhumanist movement is right.

There is nothing unusual in it of course, since the expansion of a technical civilization leads to a change of its environment. We could try to query this argumentation saying, that we could imagine not only technical civilization similar to us, but other kinds, too. But Kardashev's typology based on an extension of the human way of development, and there wouldn't be any opportunity to interpret the meaning of 'Type IV civilization' if it is not a technical civilization and it is not similar to us.

Kardashev created his taxonomy to identify the possible targets of the search for extraterrestrial civilizations, but it is simply indifferent from a cosmic point of view, whether we are on a level of a Type I or of a Type III civilization – the only important question is whether we have the power to influence the future of the entire Universe. Supposing that it is possible physically, our ultimate possible aim is to become a Type IV civilization.

The founder of the Club of Budapest Ervin Laszlo called humans' attention to the need of a new 'planetary ethic', as our collective future depended on our collaboration. The kernel of his caution was that a new, global society would not be able to work without an ethics, which would not be able to manage the problems originated from new circumstances [14]. It would not be a foolhardiness to suppose, that when a civilization enters a next level on Kardashev's scale, and for example, begins to work not on the first, but on the second level, they have to solve some previously unparallelled problems – say to build a Dyson sphere to utilize all of the energy radiated by their central star. Therefore they have to introduce a new way of thinking to be able to do it.

An other example: Tipler mentioned that Dyson showed the feasibility of taking apart a planet, when its central Sun will expand to engulf it – 'if you are willing to take a few million years to do it' [13]. It is easy to write down, but I do not think a civilization, with only a ten-thousand-year past, can see its full meaning. We do not have an experience needed to be able to imagine a some-million-year project.

Kardashev categorized the civilizations on their accessible energy sources, regarding them as their most important and most characteristic features. But Dyson pointed out, that 'an open universe need not evolve into a state of permanent quiescence. Life and communication can continue for ever, utilizing a finite store of energy, if the assumed scaling laws are valid' [4]. That is to say, not only the available power has a vital role in an intelligence's survival in the long run. So

why not to prefer classifying civilizations on their ability to manage short or long projects? 'A mind involving permanently', wrote Arkady and Boris Strugatsky in their science-fiction novel 'A Billion Year to Doomsday' in 1975, 'would have only one aim: to change the nature of Nature.' [15] But it would take a long time. Therefore it's time to start thinking about a long time scale interpretation of our human future.

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