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Tsiolkovsky, Russian Cosmism and Extraterrestrial Intelligence

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SUMMARY

Although Konstantin Tsiolkovsky's (1857–1935) contributions as a pioneering theorist of spaceflight are well known, his equally original thinking about extraterrestrial intelligence (ETI) is only now coming to be fully appreciated as the philosophical works he wrote late in life have become available for study. Working from the philosophical premises of monism and panpsychism, Tsiolkovsky held that ETI was prevalent and that advanced life forms would become spacefaring and spread beyond their natal star systems. This led him to anticipate the Fermi Paradox and offer his own solution to why we have not seen any signs of advanced, spacefaring ETI. According to Tsiolkovsky, although such ETI could long ago have visited Earth and then uplifted us to their own level of development, we have been spared intervention in the hope that humans might develop a uniquely 'new and wonderful stream of life' to add to galactic civilization.

1 INTRODUCTION

Konstantin Eduardovich Tsiolkovsky (1857–1935) has been widely honoured for being the first person to develop the theoretical basis of spaceflight (Kosmodemyansky 1987; Von Braun & Ordway 1975; Winter 1990). In the early 1870s Tsiolkovsky, then an impoverished, hearing-impaired youth haunting the libraries of Moscow, had already begun to dream about space. Later, as a schoolteacher in the provincial town of Kaluga, located just to the southwest of Moscow, Tsiolkovsky worked on the physics of rocket propulsion into space. In 1903 he published an article, entitled 'The Investigation of Space by Means of Reactive Devices', in which he mathematically developed his theory of spaceflight (Tsiolkovsky 1903). Tsiolkovsky continued his theoretical work on spaceflight throughout his career as a provincial schoolteacher and in 1920 even published a science fiction novel describing life in orbiting human habitats (Tsiolkovsky 1920a).

During the latter part of his life, however, Tsiolkovsky concentrated more on philosophical issues than on rockets and satellites. Yet, until recently his philosophical ideas have been much less well known than his contributions to the theory of spaceflight. Whereas Tsiolkovsky's technical writings were reprinted and widely discussed during the Soviet era, his philosophical works languished in restricted archives because of their spiritual and religious content. Since then, however, these archives have been opened to the scrutiny of scholars and Tsiolkovsky is now coming to be recognized as a leading

figure of an intriguing philosophical movement called 'Russian Cosmism,' as well as a pioneering theoretician of spaceflight.

Although Russian Cosmism is difficult to define precisely, one way to characterize this movement is to say that it deals with the history and philosophy of the origin, evolution and future of the universe and humankind in their genetic unity and mutual influence. Russian cosmism, which flourished in the late 19th and early 20th centuries, combined elements from Eastern and Western philosophical traditions, as well as from theosophy, panslavism and Russian Orthodox religious thinking, with the technological optimism of that era. It included a wide range of thinkers who sought to link humanity with the cosmos: philosophers, theologians, poets, painters, as well as such scientists as Vladimir Ivanovich Vernadsky of Biosphere fame and such spaceflight theorists as Tsiolkovsky (Lytkin 1994; Dudenkov 1992).

A leading ideologue of this movement who greatly influenced the young Tsiolkovsky was the brilliant and eccentric philosopher Nikolai Fedorovich Fedorov (1828–1903). While working as a librarian in Moscow during the second half of the 19th century, Fedorov developed his "philosophy of the common task" that is said to have impressed a number of leading intellectuals of that time including Dostoevsky and Tolstoy. In Fedorov's thinking, everything in the universe from the tiniest grain of matter to the gigantic suns of distant galaxies was alive and had some degree of consciousness. As beings of the highest consciousness, humans had a special role in introducing design and purpose in the chaotic workings of nature, here on earth, in the solar system and throughout the universe. Fedorov anticipated that scientists would work out a way to physically resurrect all those who had lived before and achieve perfection through immortality. This meant that some means of reaching space must be developed to be able to gather for corporeal reconstitution all the dispersed atoms of long deceased human beings, as well as to colonize the planets so as to provide living space for all the resurrected dead (Fedorov 1970; Dudenkov 1992; Young 1979; Holquist 1985–86).

Fedorov led a monkish existence and is said to have spent most of his salary on books and helping poor students. Among those he aided was the young Tsiolkovsky whose poverty, lack of formal academic preparation and near-total deafness caused by a childhood illness kept him from attending the university. Fedorov gave him a place to work in the library, piled his desk high with books and tutored the poor and handicapped student. Although sources differ as to whether or not Fedorov explicitly pointed Tsiolkovsky towards the problems of reaching and living in space, it is clear that Fedorov's cosmic orientation greatly impressed the young student and that after his unique education Tsiolkovsky devoted the rest of his life to thinking about space, both technologically and philosophically. Furthermore, it is apparent that for Tsiolkovsky achieving spaceflight and learning to live in space were not ends in themselves, but means by which humans could escape the tyranny of earth's gravity and limited resources and eventually become the perfected, immortal beings of his mentor's vision.

During the last decades of his life Tsiolkovsky also developed an original line of thinking about the origin and evolution of intelligent life in the universe. Among his writings are a number of brief essays, written late in his

life in non-technical language and without footnotes or references, in which Tsiolkovsky outlined his thinking for the general public (Zhelnina 1983). These essays, which have not yet been published, bear such titles as 'Synopsis of Cosmic Philosophy,' 'The Eternal Activity of the Universe,' 'Natural Principles,' 'There are also Planets Orbiting Other Suns' and 'The Planets are Occupied by Living Beings'. In that these essays focus on questions about the existence, nature and evolution of life and intelligence throughout the universe they treat problems which were to become integral to the debate about the existence of extraterrestrial intelligence (ETI) that began decades later. This paper examines how Tsiolkovsky's logic as expressed in these essays and other related writings led him to conclude that extraterrestrial intelligence was common in the universe, but also to realize that one of the most powerful arguments against that conclusion was contained in reasoning which was to surface later as the so-called Fermi Paradox.

2 TSIOLKOVSKY'S 'COSMIC PHILOSOPHY'

Tsiolkovsky was a monist and a panpsychist, and the logic of his beliefs led him directly to the conclusion that intelligent life was common throughout the universe. He held that all parts of the universe, even those remote from the observer, were the same, or monistic, and that therefore the same laws must apply throughout. For example, in his monograph, *The Monism of the Universe*, Tsiolkovsky (1931) wrote that:

> We preach monism in the universe, and no more. This whole process of science consists of this striving towards monism, towards unity, towards the elementary source. Science's success is being determined by the level of the approach to unity. Monism in science comes from the structure of the universe... It is impossible to deny the unity or sort of monotony in the structure and formation of the universe: the unity of matter, light, gravity, life, and so on.

Tsiolkovsky's monism was linked to his panpsychist belief that the whole universe was alive and that everywhere was to be found the basis for intelligence if not its expression in higher beings. In his essay entitled 'Synopsis of Cosmic Philosophy' Tsiolkovsky (n.d. [a]) declared that:

> There is no substance which cannot take the form of a living being. The simplest being is the atom. Therefore the whole universe is alive and there is nothing in it but life. But the level of sensitivity is endlessly various, and depends upon the combinations of which the atom is part.

The basic building blocks of Tsiolkovsky's living universe were atoms of ether. To Tsiolkovsky the ability to sense and therefore the spark of intellect is ultimately located in these primordial atoms. They are eternal and wander the universe to be expressed and recombined in various forms during their travels. With the evolution of life from simple to more complex forms, the ability to sense located in each of these basic building blocks of matter and life accumulates to the point where one can speak of the ability to think, or intelligence. The ego of sentient creatures resides in these indestructible and peripatetic atoms and therefore can find new expressions or reincarnations with each new combination of these primordial units. Although Tsiolkovsky himself denied the connection, a textual analysis reveals that these ideas are strikingly close to those Leibniz expressed in his *Monadology* (Lytkin 1987; Carr 1930).

Using reasoning similar to that later to be embodied in the Drake Equation concerning the prevalence of ETI, Tsiolkovsky worked from the premises of monism and panpsychism as well as what he knew about astronomy and other sciences to develop his argument for the existence of life throughout the universe and the inevitable though not necessarily contemporaneous development of higher forms of life on the various planets. For example, in his essay, 'There are also Planets Around Other Suns,' Tsiolkovsky (1934) argues that since the universe is monistic, some considerable proportion of stars should, depending upon their type and stage of development, have planets orbiting them as in our own solar system. Then, in his essay, 'The Planets are Occupied by Living Beings', Tsiolkovsky (1933) asserts that on some proportion of these planets life must have developed. First, he argues that the planets revolving around the trillions of other suns are composed from the same materials as is earth, are subjected to gravity as is earth, have gases and liquids as does the earth, are bathed in rays from their respective stars as is earth from the sun, and so on. Then he reasons that at least one of the planets circling each star should be similar to earth and therefore have life. Furthermore, he argues that since life can be found in the polar snows, on the heights and in the depths of our planet, it is likely that it also exists on planets that lack the ideal conditions of our earth.

3 TSIOLKOVSKY'S ANTICIPATION OF THE FERMI PARADOX

Tsiolkovsky realized, however, that his reasoning establishing the common existence of life throughout the universe was confronted by a basic premise in his thinking dating back from his earlier work on spaceflight: that humans are bound to expand into space. He believed that humans must move out into space, as indicated in his oft-quoted phrase from this period, "The planet is the cradle of intelligence, but it is impossible to live forever in the cradle" (*Planeta yest' kolybel' rasuma, no nel'zia vechno zhit' v kolybeli*; Tsiolkovsky 1954). Tsiolkovsky (n.d. [b]) envisioned humans expanding around the solar system, colonizing planets and building orbiting habitats, tapping enough energy to nourish two billion times as many human beings as the Earth feeds and then expanding from there into the depths of the cosmos. He held that as members of a truly cosmic civilization, our descendants would be able to control nature, abolishing natural catastrophes and ending their sufferings as mortal beings, thus achieving happiness for all. It could even be argued that it was this search for happiness that attracted Tsiolkovsky to the cosmos, for that is where humanity, having learned and mastered the ways of the universe, will become truly free, perfect and immortal beings (Tsiolkovsky 1920b). Tsiolkovsky's goal of perfecting humanity in the cosmos places this philosophically-inclined rocket pioneer firmly in the Russian Cosmism tradition of technocratic-utopian thinking wherein science and technology are to be harnessed to attain universal happiness.

Yet, if space expansion was in humankind's future, as a monist Tsiolkovsky also had to assume that it was an inevitable step for other higher beings in the cosmos. Furthermore, since we were only beginning to develop as an intelligent species, Tsiolkovsky's logic led to the conclusion that those

ETI older and more advanced than us must already have crossed the threshold into space and have expanded beyond their natal star systems. For example, in his essay, 'Is there a God?', Tsiolkovsky (n.d. [c]) wrote:

> Millions of milliards of planets have existed for a long time, and therefore their animals have reached a maturity which we will reach in millions of years of our future life on earth. This maturity is manifest by perfect intelligence, by a deep understanding of nature, and by technical power which makes other heavenly bodies accessible to the inhabitants of the cosmos.

This is why, midway through his essay 'The Planets are Occupied by Living Beings', Tsiolkovsky (1933) abruptly raises the two objections by which he says "people deny the presence of intelligent beings on the planets of the universe": (1) "if these beings exist they would have visited earth"; (2) "if they exist they would have given us some sign of their existence". Although Tsiolkovsky seemingly credits other, unidentified persons for raising these objections, it is obvious that they are inherent in his monistic belief in the universality of life, evolution of intelligence and then space expansion. Tsiolkovsky's own reasoning had led him to confront what later came to be known as the 'Fermi Paradox,' or more properly as the 'Fermi Question.'

In 1950, 15 years after Tsiolkovsky's death, Enrico Fermi and several other distinguished scientists were having lunch at the laboratory at Los Alamos that had spawned the bomb. The talk was lighthearted and touched briefly upon the question of flying saucers and extraterrestrials before turning to more mundane subjects. Then, suddenly, Fermi asked in effect, "Where are they?" Everybody instantly knew that he was talking about the extra-terrestrials and he followed up his question with a series of calculations about the probability of earth-like planets, the probability of life arising on them, the probability of the evolution of higher life forms and the evolution of technology and so forth that led him to the conclusion that we should long ago have been visited by extraterrestrials (Finney & Jones 1985). After a number of suggestions to explain why we had not been visited, the matter was apparently dropped, only to surface some years later when, after Cocconi and Morrison's seminal paper and Drake's pioneering efforts, serious discussions began on systematically searching for radio signals from other civilizations in the galaxy (Cocconi & Morrison 1959; Sullivan 1966). Fermi's Question then became a weapon in the hands of those who argued that since there are no obvious signs of ETI – either from direct visits to our planet, radio transmissions or disturbances caused by mega-engineering projects – the whole logic behind the argument for SETI is wrong and that therefore we must be alone in the galaxy if not the universe (Hart 1975; Tipler 1980; Shklovsky 1976, 1984).

4 TSIOLKOVSKY'S SOLUTION

Well before this attack on SETI reasoning was mounted, in his philosophical essays Tsiolkovsky had carried out a dialogue with himself over the challenge to his logic presented by the lack of signs of advanced ETI. He did not, however, employ this challenge either to deny the existence of ETI as have some SETI antagonists, or to argue that expansion beyond one's

own star system was uneconomic to the point of impossibility as have some SETI protagonists. Not surprisingly, his solution to the puzzle seeks to reconcile the two elements so central to his cosmic philosophy – space expansion and the abundance of ETI.

Tsiolkovsky answered his first objection raised in his 1933 essay – "If these beings exist they would have visited Earth" – by writing that:

> Probably they will visit us, but it is not yet time for that. Aboriginal Australians and native Americans of past centuries were finally visited by Europeans, but many thousands of years passed before they appeared. Similarly, we also will be visited some time in the future. Probably the powerful inhabitants of other planets have been visiting one another for a long time.

Tsiolkovsky then responded to the second objection, "if they exist they would have given us some sign of their existence", with these words:

> Our means are too weak to be able to perceive these signs. Our heavenly neighbours understand that with a certain degree of development of knowledge the people themselves will prove without a doubt that the other planets are populated. Besides, because of the low development of animals, and the majority of humans, there is no reason to inform them that the planets are populated. Would this knowledge even bring harm? Would pogroms and the Massacres of St. Bartholomew result from it?

Tsiolkovsky's phrasing of his second objection and his mention of 'signs' from ETI in the first sentence of his reply to that objection could be taken to indicate that he may have anticipated that extraterrestrials would attempt to make themselves known to us by some other way than actually visiting earth. In his next paragraph, however, he seems to refer to physical visitation when he prophesies that, "the time must come when the average degree of development of humans will be high enough for them to be visited by heavenly inhabitants." Nonetheless, whether Tsiolkovsky was thinking solely in terms of physical visitation, or was open to a range of communication possibilities, the main thrust of his answer is that we are not yet ready for higher beings to contact us:

> We are brothers, but we kill each other, start wars, and treat animals brutally. How would we treat absolute strangers? Wouldn't we consider them our rivals for the possession of the Earth, and wouldn't we ruin ourselves in this unequal struggle? They cannot wish this struggle and destruction. Mankind, in its development, is as far from more perfect heavenly beings as lower animals are from people. We would not visit wolves, snakes or gorillas. We only kill them. Perfect heavenly animals do not want to do this to us. Can we really have rational relationships with dogs and monkeys? In the same manner, higher beings are not able to communicate with us for the present.

In another essay, entitled 'Natural Principles,' Tsiolkovsky (n.d. [d]) elaborates his thinking on why advanced extraterrestrials have not yet contacted us. In his view, very few civilizations develop in a natural way, passing through all possible sufferings and trials on their way to obtaining happiness. The first advanced civilizations strive to perfect their more backward neighbours, raising them to their level. In so doing, however, they extinguish the unique evolutionary streams of their less advanced neighbours. However, earth has been deliberately exempted from this process. We have been set aside as a reserve of intelligence in order to allow our species to evolve to perfection and thereby bring something unique to the cosmic community of intercommunicating ETI:

> Why don't the beings of happy planets deign to come down to us? Why don't they pity us, and replace us with higher beings, destroying us so that we can then arise in their perfect image?... If they didn't expect anything of a high level from us, then they wouldn't have tormented us for so long. Apparently, there is hope that something worthwhile will develop from us. They know better. We doubt, but they know. We can bring a new and wonderful stream of life that will renew and supplement their already perfected life.

Tsiolkovsky's solution to the puzzle of why we have not had any contact with advanced civilizations anticipated ideas contained in a pair of papers published some forty years after Tsiolkovsky penned his manuscripts. We refer to Ball's often cited 'zoo hypothesis' that earth has been set aside by advanced civilizations as a zoo or nature preserve (Ball 1973), and the amendment to that hypothesis offered by Kuiper and Morris (1977) to the effect that the earth is being quarantined so that our evolution might proceed to the point where we could provide unique information, the only valuable resource our planet could possibly offer to advanced ETI.

5 DISCUSSION

To say that Tsiolkovsky was, along with Robert Goddard and Hermann Oberth, a pioneering spaceflight theorist and leave it at that would be to vastly understate his importance as a seminal thinker of the space age. Tsiolkovsky's writings did much more than stimulate engineers to develop rockets capable of reaching space. His ideas about humans living permanently in orbiting habitats and processing space resources foreshadowed the space colony movement promoted in the 1970s by O'Neill (1974), and his vision of our descendants one day reaching immortal perfection in space is now being reinvented by such contemporary scientists as Moravec and Tipler (Moravec 1988; Tipler 1994; Regis 1990). To this list of firsts, must now be added Tsiolkovsky's anticipation of the Fermi Question and his answer to it. As a prophet of human space expansion and a passionate advocate of the idea that extraterrestrial intelligence is prevalent, Tsiolkovsky realized the seeming logical paradox involved in maintaining these two lines of thinking. His solution, expressed in the rich idiom of Russian Cosmism, sought to reconcile his twin visions of humanity expanding beyond our solar system and a universe filled with intelligent life.

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