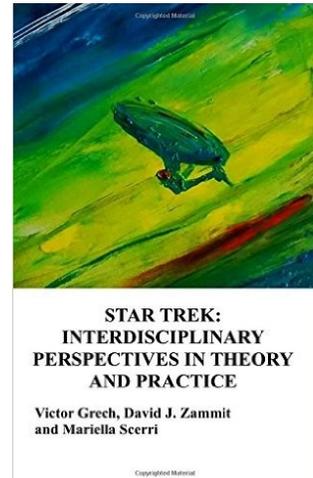


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The Raelian hypothesis: Star Trek-like origin and spread of intelligent life in the galaxy

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ABSTRACT

In the Star Trek episode "The Chase", the protagonists learn that all humanoid life in our galaxy (Humans, Romulans, Klingons and Cardassians) share a common origin: they are all the result of genetic engineering by the first humanoid species in the galaxy. The exponential nature of technological progress in our terrestrial civilization suggests that habitable planets in our region of the universe might become populated by our own creatures in the distant future, making us Founders of new intelligent life made in our image. But what if we are not the first intelligent life in our galaxy? Is

it possible that life on Earth is the result of a scientific experiment by an advanced extra-terrestrial civilization? In this presentation we will explore this fascinating hypothesis, first proposed by the Raelian Movement 20 years before "The Chase" episode, and examine how it could be reconciled with modern science, from paleontology to genomics.

Introduction

The Star Trek Expanded Universe web site lists 84 “hybrid characters” (“Hybrids”), defined as humanoid persons with “two or more different species in their ancestry”, that have appeared in one or more Star Trek episodes. In many cases, these so-called hybrids are perfectly fertile and have their own offspring, which, to a modern biologist, is a clear sign that they are not actual hybrids, and that the supposed different species are in reality sub-species of a single human species. Despite sharing 98% of their genome, as 21st century terrestrial science has discovered, gorillas, chimpanzees and orang-utans are not interfertile, which indicates that a high level of genetic identity is necessary for successful interbreeding, an extremely unlikely outcome of life evolving independently on different planets. Indeed, during the Chase episode (Frakes), the Enterprise crew discovered that terrestrial humans shared a common ancestry with Romulans, Klingons, Cardassians and other humanoids. They learned that they were the products of a genetic experiment by the first humanoid species in the Milky Way galaxy, which had seeded several planets with its own DNA. The seeding likely involved not mere primitive life, but the human genome itself, as interbreeding requires a common genetic program, which does not exclude the possibility of large phenotypic variability. Therefore, morphological differences between Terrans, Romulans, Klingons and other humanoids are of the same nature as those between Chinese, African or European individuals on today's planet Earth for example. A common genetic program is shared, but implemented using different parameters.

Are we living in a Star Trek-like universe?

What relevance could such a scenario from the Star Trek universe have in the real world? Before defining the problem and searching for possible supporting evidence in our past or present, let's first explore our likely future by extrapolating current trends in selected technological disciplines.

The field of DNA sequencing has seen a remarkable evolution in recent years. The first human genome,

announced in year 2000 as a preliminary draft, cost \$3 billion and took over a decade to complete. The cost to sequence a human genome subsequently fell to \$1 million in 2007, \$50,000 in 2010 and just \$1,000 in 2014 (“\$1,000 genome”). To this date, 228,000 individuals had their genome fully sequenced, a number that is expected to double every 12 months from now on (Regalado).

In parallel to DNA sequencing, DNA synthesis and assembly, which now include gene synthesis and even genome synthesis, has seen spectacular achievements as well, both in terms of cost and length. A complete viral genome (phiX174, 5,386 base pairs in length) was synthesized in 2003 (Smith), and the first synthetic bacterial genome (*Mycoplasma genitalium*, 582,970 base pairs) was assembled in 2008 (Gibson), both by the famous Craig Venter's group.

Space exploration is another arena of exciting developments. In 2013, the Voyager 1 probe became the first man-made object to leave the solar system (Landau). No less than two projects to colonize planet Mars have been launched: both Elon Musk's SpaceX (Malik) and the Dutch non-profit Mars One (“Mars One”) plan to start permanent human settlements on Mars by the middle 2020s. While just three decades ago the question of whether planets existed around stars other than our sun was still being debated, today over 1800 exoplanets have been discovered, and it is estimated that our galaxy alone hosts at least 11 billion potentially habitable Earth-sized planets (“Exoplanet”). Faster-than-light travel, although still in the realm of science-fiction, is increasingly being viewed as a theoretical possibility, to the point that even NASA is working on a faster-than-light warp drive project (Dvorsky).

What can we learn about our future from these few examples of the scientific and technological revolution that is currently taking place at an accelerating rate? The following predictions are both mind-boggling and quite reasonable given our current reality. The cost of DNA sequencing will eventually become negligible. As a result, every human being alive (or even dead) will have their genome sequenced, as well as pets, farm animals, food products, environmental specimens, etc. This will lead to an increasingly detailed understanding of all existing genomes and their variations. As the efficiency and affordability of DNA synthesis and assembly increases, it will be possible, not only to synthesize entire genomes, but also to design new ones. Extinct creatures such as woolly mammoths, giant ground sloths, sabre tooth tigers or perhaps even Neanderthals will be resurrected. Novel animal pets with altered fur color, body shape or behavioral traits will be designed. Human settlements will be created on Mars and eventually on exoplanets. Will these settlements include plants and animals transported from Earth? Obviously not, if the technology to synthesize them *in situ* exists. What the

astronauts will be carrying with them as they travel through space will be their knowledge of synthetic biology and their technology. An important advantage of synthesizing life as opposed to carrying existing life around is the possibility of adjusting any genome setting in order to adapt to local conditions and needs. We will be playing gods, creating life from non-living matter in new worlds!

Terrestrial humans: the next ancient humanoids?

It seems reasonable to imagine that future scientists, mastering both the technology to synthesize life and the ability to travel in space, may decide to settle on a new planet and use it as a playground to create new life forms, unhindered by their home planet's ethics committees and public opinion. An obvious, although extremely ambitious project would be to re-create life “from scratch”, to populate the new planet with synthetic life forms in a systematic way. This would be an attempt to replicate our own origins, albeit in a controlled, directed and therefore accelerated manner, with the help of powerful computers, so that instead of the supposed hundreds of millions of years, the time scale would be compatible with a human lifespan, which by then might be dramatically increased. The result would be a new ecosystem, including new human beings created in our image. Not necessarily a perfect replica of life on our original planet, but rather a new implementation of it, based on the same principles but adapted to the local environment and reflecting the creativity and artistic vision of the scientists. When realizing the implications of their work, the scientists may decide to let the newly created mankind progress by itself without interfering in its evolution. They may even decide to hide all scientific evidence of their creation, so that the new humanity would think it had evolved there naturally, or would view its creators as mythological gods. The same process could be repeated on different planets, making our future scientists the equivalent of the Star Trek ancient humanoids, “seeding” new worlds with synthetic life made in their image.

The Raelian hypothesis

In their famous paper on directed panspermia, Crick and Orgel referred to what they called the “theorem of detailed cosmic reversibility” (Crick) to argue that if we can seed other planets with life, then it is reasonable to assume that extraterrestrials could have seeded life on our planet. The same reasoning can be applied to the story described above. If the creation of life, including humans in our image, on another planet by future terrestrial scientists, in such a way that the created life has reasons to believe that it had originated there, is a plausible scenario, then the idea that life on Earth is the result of

a scientific creation by human extraterrestrials is a perfectly valid hypothesis. This is precisely what was first proposed by the Raelian Movement two decades before the Star Trek episode “The Chase”. The Raelian Movement is an atheist religious organization founded by Claude Vorilhon, now known as Maitreya Rael, following encounters with what he described as extraterrestrial human beings in 1973 and in 1975 in France (“Raelian Movement”). The Raelian hypothesis described here is an essential part of the revelation that constitutes the foundational religious text of the Raelian Movement (Rael). It differs from both directed panspermia (Crick) and the ancient astronaut hypothesis (“Ancient astronaut hypothesis”) in that both assume that life evolved on Earth (after Earth was seeded with primitive life for directed panspermia; before extraterrestrials manipulated hominid genomes for the ancient astronaut hypothesis), while in the Raelian hypothesis all life was created scientifically and no evolution occurred except in the minds (and perhaps the computers) of the creators.

To what extent is the Raelian hypothesis compatible with today's scientific knowledge? What follows is an attempt to address this question, not from an orthodox Raelian perspective but rather as an open exploration free of religious doctrine.

The Raelian Movement has often publicly endorsed the Intelligent Design movement, to the point that it renamed its main religious book as “Intelligent Design - Message from the Designers” in 2005. But how related really is the Raelian hypothesis to the doctrine of Intelligent Design? One of the most common arguments by supporters of Intelligent Design is that the cell is too complex to have evolved naturally and that therefore it must have been designed. Such an argument seems irrelevant to the Raelian hypothesis, since the creators share the same biology as the created and are themselves made of the same kind of cells, which therefore can not be considered as having been designed by them. The creators may have recreated cells *de novo*, but with the goal of replicating something that already existed, not inventing something new. In its strictest sense, Intelligent Design would have occurred if an extraterrestrial entity not made of life as we know it invented the life that we know, as a novel concept. For example, they would have invented the idea of a cell, of DNA as storage of genetic information, of enzymes, etc, and designed rationally all the individual parts and mechanisms. This is obviously not what the Raelian hypothesis is about. We could imagine a weaker definition of Intelligent Design, in which the creators share the same basic biology but are not human, and design the human being as a novel concept. Again, this is not the Raelian hypothesis, for which the created and creator are both human. Defending the Raelian hypothesis using such definitions of Intelligent Design would lead to self contradictions, such as “how could the designer of the cell be made of cells before the cell

was designed” or “how could the designers of the human being be themselves human beings before they designed the human being?” Clearly, what is called “Intelligent Design” by the Raelian Movement is unrelated to the ideology of the Intelligent Design movement. What is actually meant by “Intelligent Design” from a Raelian point of view is not an explanation on how life originated, but rather how an existing life replicated itself using science, in other words using their intelligence to design scientific experiments and create living organisms from non-living matter. In order to prevent more confusion, the spelling “Intelligent Design” will be used from now on in this text for the idea promoted by the Intelligent Design movement, and “intelligent design” (without capitals) for the broader idea of intelligent intervention such as the one described in the Raelian hypothesis. Using an analogy, the intelligent design in the Raelian hypothesis is similar to the creation of a literary work in an existing language, while Intelligent Design would be about the origin of that language. It can be noted that whether the language was designed or evolved naturally is irrelevant to the writing's literary quality and to the acknowledgement of the author's identity.

A similar confusion exists with the usage of the word “evolution”. The Raelian Movement has often rejected evolution with strong language, claiming that evolution does not exist or that evolution is impossible. Clearly, what is meant by “evolution” in this context is the idea that life evolved naturally on Earth without any intelligent intervention. In contrast, most modern biologists have a much broader understanding of the word, as illustrated by the following definition from Wikipedia: “Evolution is the change in the inherited characteristics of biological populations over successive generations” (“Evolution”). Again, to prevent further confusion, the spelling “Evolution” (with capital E) will be used hereafter to designate the idea that life originated and evolved through natural processes specifically on Earth, while “evolution” will be used for the more general meaning of genetic change across generations. From these definitions, it can be argued that “Evolution” is a hypothesis that can reasonably be questioned, while “evolution” is an intrinsic property of life that has been so widely observed and documented that it is a universally accepted fact.

In light of these precisions, the Raelian hypothesis might be more accurately described as the reproduction of a supraorganism on a cosmic scale, rather than an atheist version of the Christian Intelligent Design. This supraorganism would be the planetary ecosystem, and its genome would be the global metagenome. The supraorganism's purpose would be to reproduce across the universe from planet to planet. Reproduction would only take place when the supraorganism reaches maturity, which would occur when the intelligent life that composes it reaches a level of scientific and technological

progress allowing it to travel to space and create synthetic life. And like biological reproduction, the supraorganism's reproduction would allow a wide range of variation at each cycle, while propagating a core genetic program with high fidelity.

Supporting logical argument

The plausibility of the Raelian hypothesis as an explanation for the existence of life on a given planet can be explored through the following logical argumentation.

Assuming that future terrestrial scientists may travel to other planets, create life on them including human life in their image, and then let the newly created life develop by itself while hiding evidence of their intervention, there is no reason why the newly created life would not repeat the same process. How long would it then take for the entire galaxy to become populated with life?

Let's assume that there are 10 billion habitable planets in our galaxy (a conservative estimate according to modern astrobiologists). The duration of a cycle of creation can be estimated by noting that it took thousands of years for mankind to progress from stone age level to our current level, and it could conceivably take thousands of years for terrestrial scientists to create life on another planet. Therefore a full cycle could probably require somewhere between 10 and 100 thousand years. Assuming an optimistic scenario in which each humanity creates life on 10 new planets and each cycle lasts 10 thousand years, the number of 10 billion planets would be reached within only 11 cycles, or 110,000 years. Assuming 3 new planets and 25 thousand years per cycle, 22 cycles, or 550 thousand years would be necessary. Under a more pessimistic scenario in which each humanity creates life on only 2 new planets and each cycle lasts 100 thousand years, it would take 34 cycles, or 3.4 million years, for 10 billion planets to be implanted with life.

According to current mainstream understanding of the history of life on Earth, life evolved during 4 billion years before producing the first modern humans. Yet, under the most conservative model described above, once intelligent life exists on a single planet, it would take less than 0.1% of that time to spread life to our entire galaxy through cycles of scientific creation. The implications are staggering. The assumption by most astrobiologists that life can only exist on a given planet if it had originated and evolved there, need to be completely reevaluated, taking the reality of today's revolution in synthetic biology and its likely implications into account. Intelligent life can not evolve more than once in a

galaxy (or possibly a larger region of the universe): all habitable planets will be inhabited as a result of the cycles of creation initiated by the first life before a second intelligent life has the time to evolve. In other words, if intelligent life exists on a given planet, the likelihood that it has been scientifically created by a preexisting life is exceedingly higher than the probability that it has evolved there. Regarding life on Earth, the conclusion is inescapable and mind-blowing: either we are the first intelligent life in the galaxy or life did not evolve on Earth!

It should be noted that the Raelian hypothesis is not the only way life could spread across the galaxy. Many other possibilities can be thought of, from simple colonization to Intelligent Design *stricto sensu* (the rational design of a novel kind of life) and anything in between. Another interesting observation is that the requirement for an origin (the first intelligent life initiating successive cycles of scientific creation) recedes as the possibility of larger scale travel increases. Indeed, if intergalactic travel is possible, then there is no requirement for a first intelligent life to have evolved within our galaxy. Pushing this logic to the extreme, assuming our universe is just one among an infinity of other universes in an infinite multiverse, and if travel between universes becomes possible, then there is no logical requirement for an origin at all. However, infinity does not imply that a cycle of creation must be infinite. An infinite number of finite cycles is another, perhaps more rational possibility.

Geological evidence

Available geological evidence, such as fossils and radiometric datings, seems to support the idea that life evolved on Earth during hundreds of millions of years. But could it also support the Raelian hypothesis, and if so, under which assumptions?

If extraterrestrial scientists who believed that life evolved on their own planet created life on Earth as an attempt at replicating, under controlled and accelerated conditions, what they thought were their own origins, then we should actually expect to find fossil evidence supporting Evolution (fossils of less complex life in older geological layers and of more complex life in more recent layers). The only discrepancy would involve the age of the fossils and geological layers, as such an experiment could conceivably last centuries or millenia, but definitely not millions or billions of years. But what if the extraterrestrial creators actually wanted to hide their intervention and deliberately altered the planet on a global scale so that it would appear to naïve observers that life had developed there through natural processes during hundreds of millions of years? This would certainly be consistent with the Raelian

revelation, according to which our creators were unaware of having themselves been created scientifically until they were contacted by their own creators, thousands of years after creating us. With their highly advanced scientific level, it seems unthinkable that they could not have understood their real origins unless they had compelling evidence strongly suggesting that life had evolved on their own planet during hundreds of millions of years. How could such kind of evidence have been manipulated is a question that belongs to the domain of science-fiction for now, but there are indications that the idea should not be dismissed as totally unrealistic. Indeed, it has been shown during the past few years that radioactive decay of many radionuclides such as isotopes of caesium, thorium, uranium and others can be accelerated experimentally through exposure to a laser beam (Barmina). If a technologically advanced civilization could master this technology and scale it up to the level of a whole planet, it could make events appear thousands or even millions of times older than they actually are, assuming that absolute ages of geological features are computed using radiometric dating methods. Perhaps, as in the Star Trek universe, a kind of Prime Directive is guiding life-creating civilizations and prompting them to conceal the nature of their intervention, in order not to interfere with the natural scientific and technological development of the newly-created life.

DNA evidence

In addition to geological evidence, DNA evidence is an increasingly important approach to the study of life and its history. A significant difference is that, while geology specifically reveals information about location and time but not about actual biological processes, DNA tells about what happened and to some extent when, but says nothing about where it happened. This difference is worth keeping in mind as we explore, as an alternative to the mainstream view that life originated on Earth, the idea that we are actually dealing with two distinct phenomena, one being the origin of the core features of life (revealed by DNA evidence), the other being the implementation on our planet of an existing life (informed by geological evidence).

Before the modern era of massive DNA sequencing, proponents of Intelligent Design were hoping that the approaching DNA revolution would reveal indisputable signs of design in the spelling of the genes and eventually genomes that would be analyzed. The exact opposite came true: comparative analyses of millions of genes and even whole genomes have constantly and overwhelmingly validated evolution (but not Evolution, the nuance is worth noting) and discredited Intelligent Design as an explanation for life's fundamental genetic features (see review in Theobald). The evidence is so compelling that the

only conceivable way a designer could have been involved would be if the designer specifically wanted life to appear as if it had evolved. In order to achieve such a result, the designer would have used evolutionary tools, in which case the process could not be called Intelligent Design anymore but rather directed evolution (using intelligently designed experiments, computers and algorithms, for sure).

Contrary to what a simplistic view could suggest, DNA evidence for evolution and against Intelligent Design not only does not undermine the Raelian hypothesis, it actually validates it. Indeed, according to the Raelian narrative, our creators did not design a new kind of life on Earth but rather created a synthetic implementation of their own kind of life, including humans in their image. A logical consequence is that the defining features of life as we know it, or of what makes us human, were not designed by our creators (they were rather re-created, down to the smallest details), because they are themselves as alive and as human as we are. The origin of those defining features predate the history of life on both our and our creators' planets. As with the geological evidence, the available DNA evidence seems again consistent with the Raelian revelation, according to which our creators, with their immense scientific knowledge and perfect understanding of biology, remained unaware of having themselves been created even for thousands of years after creating us. In other words, they thought of themselves as having evolved on their own planet, they created us in their image, in the image of what they considered to be the product of evolution, and the completion of their creation did not alter their understanding of their own origins. The logical implication is that if the Raelian hypothesis is true, then modern as well as future science should not find evidence for Intelligent Design in the genetic information of life on Earth, which should look exactly as if it was the product of evolution. This prediction has so far been validated.

Non-scientific evidence

As illustrated in the Star Trek episodes “The Paradise Syndrome” (Taylor) and “Who Watches the Watchers” (Wiemer) in which Enterprise crew members are mistaken for gods by primitive societies, non-technologically evolved cultures have a natural tendency to interpret as supernatural what they are unable to comprehend. This phenomenon has been observed as recently as during the 20th century through the various cargo cults that developed following contacts between colonial powers and isolated tribes (“Cargo cult”). If extraterrestrials scientifically created life on Earth, then the newly created humans would be expected to develop religions worshipping their creators as gods who made them in their image, and the creators themselves could have used religions to help the new humanity progress

morally and spiritually without interfering with its natural scientific and technological development. In this view, existing terrestrial religions and myths could legitimately be considered as evidence supporting the Raelian hypothesis.

The UFO and crop circle phenomena could also be viewed as attempts by an extraterrestrial civilization to subtly influence humanity to prepare psychologically for an eventual contact, by providing enough clues to generate attention and questioning, while at the same time refraining from disclosing indisputable evidence, so to not interfere directly with our progress. As such, these phenomena are consistent with the Raelian hypothesis.

Finally, perhaps the most powerful evidence supporting the Raelian hypothesis is what could only be described as artistic design in nature. The plant and animal worlds are full of examples of stunning beauty, harmony and even humor. When taking the time to explore and observe the diversity of life on our planet, one can only be amazed at the fragrances of flowers, the tastes of fruits, the colors of fish and birds, the complex mating rituals involving impressive dances and vocalizations, or the extravagant features of some birds and plants. Such beauty seems very unlikely to be the product of evolution, and intuitively suggests the involvement of artistic designers. Obviously, this is only a subjective type of evidence, as there is no easy way to quantify beauty or humor. As to whether evidence for such design should be detectable at the DNA level, it seems unlikely, considering the apparent decision by the creators not to leave any indisputable evidence of their involvement.

Conclusion

The Raelian movement has inspired a decent amount of scholarly work since its inception (“Scholarly publications on the Raelian Movement”), mostly from a sociological or religious perspective. This is the first attempt to specifically address the Raelian hypothesis, narrowly defined as the idea that life on Earth was scientifically created by extraterrestrial human beings, as a possible scientific hypothesis, and examine its plausibility under the light of today's scientific knowledge.

The Raelian hypothesis, when examined rationally without religious interference, appears to be both logically sound and surprisingly compatible with modern science. It predicts that no direct evidence of extraterrestrial intervention should be observed in past geological layers or in the DNA of terrestrial organisms, while vast amounts of subjective evidence should be expected in the form of past religious

teachings, UFO sightings or artistic features of plants and animals. The Raelian hypothesis is being substantiated by the current scientific technological revolutions, particularly in synthetic biology and space exploration. The first direct evidence validating it might occur when evidence of extraterrestrial life becomes available, particularly if the nature of that life is similar to ours.

The Raelian hypothesis is an intriguing and fascinating hypothesis with a level of scientific legitimacy that is on par with that of directed panspermia for example. In fact, the Raelian hypothesis could be considered an extreme and updated version of directed panspermia.

When we finally encounter other humanoid life in a not so distant future, awareness of the Raelian hypothesis should help us realize our common origin faster than the Terrans, Klingons, Romulans and Cardassians in the Star Trek Universe.

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