Extraterrestrial Intelligence: A Cognitive Evolutionary Perspective

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ABSTRACT

We evaluate claims for extraterrestrial intelligence based on the logic behind assertions such as the absence of evidence is not evidence of absence. To assess intelligence elsewhere in the universe we outline two of the principle scientific claims for intelligence on Earth. One involves the idea that intelligence involves working out the reasons for our own existence. The other involves self-awareness and the capacity to make inferences about what others know, want, or intend to do. The famous quote from Rene Descartes "I think; therefore, I am" needs to be revised to read "I am; therefore, I think." Some of the conclusions we derive about intelligence include the idea that most species on planet Earth have clever brains but blank minds (no self-consciousness); humans are the only species where what you know could get you killed; if humans become extinct it is highly unlikely that human-like intelligence will re-emerge on this planet and the odds of human-like intelligence evolving on other worlds is infinitely small. However, if intelligence exists elsewhere in the universe it may not have revealed itself because humans are dangerous and are perceived as posing too great a risk.

Key Words: self-awareness, mental state attribution, consciousness, principle of limited imagination

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1. Introduction: Extraterrestrial Intelligence?

Many scientists have attempted to make inferences about technologically advanced intelligent life on planets in other solar systems (Falk 2022; Horvat, 2015 Joseph & Duvall, 2021; Wright & Sigurdsson, 2016). NASA has even funded a project to search for energy capturing "Dyson Sphere" megastructures, fashioned by extraterrestrial civilizations and that may be orbiting distant stars (Oberhaus & Donlin, 2021). However, although there is controversial evidence supporting the hypothesis that prokaryotes and simple eukaryotes which may have colonized Mars in the ancient and recent past (Armstrong, 2021a,ab; Bianciardi et al., 2021; Elewa, 2021; Joseph et al. 2020a,b; Latif et al. 2021; Suamanarathna et al., 2021) the only empirical proof of intelligent life, is on planet Earth. Moreover, even if "Dyson Spheres" are discovered by NASA at some future date (Oberhaus & Donlin, 2021), given the history of life on Earth,

we must consider the possibility that self-aware, technologically advanced, intelligent life on other planets, may have become extinct.

In the history of our planet, over 99% of all eukaryotic species have gone extinct (Jablonski, 2004), over 5 billion species including terrestrial mammals. As a result, life as we know it today is the mere tip of the iceberg when it comes to the history of life on this planet.

2. Intelligence and Questioning the Why of One's Existence

What distinguishes intelligent life from other life forms? Dawkins (1979) speculated that intelligent life comes of age when it works out the reasons for its own existence. Falk (2022) makes reference to brain size, cognition and intelligence, and notes that despite their large brains cetaceans lack the ability to create tools and technology, whereas a subset of primates developed tool technology and grammatical language and became the intellectually dominant species on this planet.

The theory of evolution is the most widely accepted scientific account of life on planet earth and, by that yardstick, the only species that we know of, that has attempted to identify the reasons for its own existence is *Homo sapiens;* and no other life form past or present comes even close to developing the technology we have today. The stepping stones for the impetus to human technology consisted of such things as the discovery of leverage and the invention of the wheel. Civilization can be defined by the development of means to store acquired information in a relatively permanent form that can be reproduced and widely disseminated over time and space. Although Gutenberg's printing press was created in 1450, it was not until over 400 years later (1859) that Charles Darwin published his account of life based on the theory of natural selection.

While there are many animals that exhibit considerable sophistication and complexity in their anatomy, physiology, and behavior, humans are unique in applying these evolved cognitive abilities to answering questions about their origins, existence and mortality. It is often presumed that any intelligent highly technologically advanced extraterrestrial life we encounter may have insights into these matters that are on a par with or even exceeding our own. Yet, what if "intelligent" extraterrestrials "evolved" from insects? Although insect societies appear complex and intelligent, there is no reason to suspect they ask questions about the nature of existence. With the exception of humans, even complex, sophisticated life forms do not appear capable of possessing knowledge about life and death or asking questions about the cosmos. If intelligent life evolved on other planets there is no reason to suspect they may think like humans.

3. Self-Awareness

As a testable alternative to Dawkins (1979) approach, another way to define intelligent life both here and elsewhere is *self-awareness*. Some scientists contend that because there is no way to experience anyone else's experience, a sense of self or self-awareness falls outside the realm of science. Although no one can experience your experience, behavioral scientists can experience and measure your behavior and therefore they can use your behavior to infer your experience. If self-recognition is defined by the capacity to become the object of your own attention (Gallup & Anderson. 2020), when you confront yourself in a mirror you have literally become the object of your own attention; i.e. self-consciousness.

Unlike humans, most other visually capable species react to themselves in mirrors as if their reflection represented another individual; and thus they engage in a variety of species typical social responses (e.g., aggressive behavior, social gesturing, and vocalizations) directed toward their mirrored image (Gallup & Anderson 2020). Even after prolonged experience with mirrors most species seem incapable of realizing that their behavior is the source of the behavior being depicted in the mirror. Some species eventually habituate to the presence of the "other" individual in the mirror and lose interest, while others persist in showing social behavior toward the mirror (De Veer et al. 2003).

When chimpanzees initially see their reflections in mirrors they respond as if they were seeing other chimpanzees (Gallup, 1970). But after several days they begin to use the mirror to inspect and manipulate features of themselves that they have never seen before, such as making faces at the mirror, inspecting their anal/genital area, and looking inside their mouths. After being anesthetized and marked with a red dye on parts of their faces that cannot be seen without a mirror, and as evidence for self-recognition they then use the mirror to touch and investigate these strange red marks (Gallup. 1970).

Although many claims have been made for mirror self-recognition in other animals, using this procedure there are only three species (chimpanzees, orangutans, and humans) that have consistently shown compelling, reproduceable, and rigorous experimental evidence of being able to decipher mirrored evidence about themselves (Gallup & Anderson. 2020). All of the great apes, including humans, share a now extinct protohominid ancestor in common. Orangutans were the first to diverge from this line and are thought to be the most similar to the protohominid precursor. There is a provocative theory that the impetus for social intelligence got its start from the fact that because of their large body mass there was selective pressure on arboreal orangutans to develop a sense of personal agency as a means of testing the fragility of limbs in the canopy to minimize the chances of falling (Povinelli & Cant 1995).

It should also be noted that despite frequent claims for intelligence in cetaceans and especially bottlenose porpoises (Falk 2022), not only is the evidence for mirror self-recognition weak and the

methodology often questionable, but in spite of unusually large brains, their other accomplishments in the intellectual domain are not nearly as profound as some would like to believe (Marino et al. 2007; Marino et al. 2008). For a compelling and rigorous review of the faulty thinking, poor methodology and weak evidence for intelligence in cetaceans see Manger (2013). It is important to remember that sophisticated, symbolic communication among cetaceans must be a matter of fact and not faith. Unlike the latter, the former remain in short supply.

Prior to 18 months of age most human infants respond similarly to non-human animals when confronted with their reflection in a mirror and treat their image as if it were another child. Despite the time and effort many parents spend in front of mirrors attempting in vain to train their children to "recognize" themselves in the mirror, it is not until two years of age that most children show self-recognition.

Mirror self-recognition is an important cognitive indicator. For example, it has been argued that an organism that can become the object of its own attention is in a position to begin to use its own experience to make inferences about comparable experiences in others (Gallup, 1982). Most human beings share the same receptors and underlying brain mechanisms in common and therefore there is bound to be considerable overlap between your experience and those of others.

This proposition can be tested in any number of ways. If given experience with different visual obstructions such as blindfolds or opaque goggles, most people are able to infer the inability to see in other comparably obstructed individuals. In one such study after children of different ages were given the opportunity to play with both clear and opaque goggles in a nursery school setting, the next day when confronted by their mothers wearing opaque goggles, the children old enough to recognize themselves in the mirrors acted as if their mothers could not see. Prior to reaching that age, younger children failed to distinguish between whether their mother was wearing either clear or opaque goggles and did not realize that while wearing opaque goggles she could not see. To apply the same logic to a hypothetical example, imagine that you were to teach a captive baboon to vocalize in order to receive a food reward such as a raisin. Once the baboon learns over a series of days to vocalize when you enter the room for raisins, you give the baboon experience with different auditory obstructions such as headphones. Then the next day you enter the room wearing the familiar pair of headphones to see if the baboon will raise the volume of its initial vocalizations in an attempt to compensate for your inability to hear. This is a testable/falsifiable hypothesis and given that baboons consistently fail tests of mirror self-recognition (Anderson & Gallup. 1999) they would be expected to fail to use their experience with headphones to infer your obstructed

ability to hear.

The expansion and refinement of self-awareness paves the way for the development of social intelligence (Gallup, 1982). Not only can we use our experience to infer comparable experiences in others but, given a knowledge of our own mental states and their relation to external events, we now have a means of inferring mental states in others. In other words, knowledge of self builds the foundation for an introspectively derived knowledge of others. As a result, social intelligence is expressed by the emergence of increasingly more sophisticated social strategies for inferring and effectively responding to emotions and mental states in others such as gratitude, grudging, sympathy, empathy, deception, and sorrow. Based on this ability to infer what other people know, want, or intend to do, human competition for scarce resources and mating opportunities has come to be waged, not only in terms of physical prowess, but increasingly in terms of more cognitively sophisticated social interactions. Indeed, with the industrial revolution intellectual prowess in humans has in many instances come to supplant physical prowess as a means of achieving upward mobility in socioeconomic dominance hierarchies.

It is important to acknowledge that self-awareness and social intelligence, rather than being an alternative to Dawkins' definition of intelligence actually subsume it. One first has to be aware of their own existence before they can begin to work out the reasons for that existence. From this perspective, the famous quote from Rene Descartes, "I think; therefore, I am" would have to be rewritten to read, "I am; therefore, I think." It is your ability to conceive of yourself in the first place and ponder your own existence that makes mental state attribution and thinking possible.

4. Extraterrestrial Life

Should we ever encounter complex life elsewhere in the universe--species more advanced that bacteria, algae, lichens, and fungi-- a parsimonious and straightforward measure of whether it might be intelligent would be to assess its capacity to recognize and decipher mirrored information about itself.

The history of biology on earth makes it clear that intelligent, technologically sophisticated life is the exception rather than the rule. Despite billions of different lifeforms, the track record of intelligent life with complex tool-making capabilities and the cognitive ability to achieve self-consciousness, indicate that it has only appeared once, which makes the prospect of finding technologically sophisticated intelligent life elsewhere exponentially remote.

Consider again, the planet Mars. Although prokaryotes and perhaps algae may have colonized the Red Planet over 3 billion years ago, and despite controversial evidence that tube worms and simple legless metazoans may have evolved (Armstrong, 2021a,ab; Bianciardi et al., 2021; Elewa, 2021; Joseph

et al. 2020a,b; Latiff et al. 2021; Suamanarathna et al., 2021) no serious scientist has made the claim that this progression led to the evolution of intelligent Martians. Likewise, although light-blocking mega-structures appear to be orbiting ancient stars, suggestions about energy capturing "Dyson Spheres" are purely speculative (Horvat, 2015 Joseph & Duvall, 2021; Wright & Sigurdsson, 2016) and may be due to massive groupings of orbiting comets or moon-size debris.

Due to the number evolutionary transitions necessary for tool-making, grammatically speaking, intelligent life to emerge, the chances of anything resembling human intelligence to have evolved elsewhere would be "vanishingly small" (Gould, 1990). Another way to emphasize this point is with statistics. Statistical inferences require taking into account the sample size (N) to determine the degrees of freedom by the formula N-1. With a sample based on a single instance, the degrees of freedom drop to zero. Which means that based on inductive logic there is no statistically responsible basis for inferring that technologically advanced intelligent life exists elsewhere; a principle consistent with the Law of Parsimony or Occam's Razor. An alternative interpretation is that the law of parsimony actually amounts to the principle of what we call limited imagination. God, metaphorically speaking, does not always shave with Occam's Razor.

Some might argue that the absence of evidence is not evidence of absence, and therefore the presence of human-like intelligent life elsewhere remains viable. Hence, NASA's program designed to detect energy capturing megastructures orbiting distant stars (Oberhaus & Donlin, 2021). Yes, something is blocking the light from a few stars in other solar systems. Yes, anomalous objects have been observed and filmed moving at tremendous speeds by U.S. Navy pilots. However, a few hundred years ago, similar observations--including comets passing overhead or eclipses of the sun or moon-- have been claimed as evidence of angels or the wrath of god. Science is a matter of fact, not faith, and it is important to realize that in some instances the absence of evidence can indeed be evidence of absence. In order to be a scientific question, it has to be an empirical question, a question that can be answered based on convincing evidence that can be scientifically replicated and validated; i.e. a testable hypotheses that can be verified or falsified.

Replication is one of the cornerstones of science. This also applies with equal force to the null hypothesis or the absence of an effect. If the absence of an effect can be replicated enough times under different conditions, then eventually we have to begin to take the null hypothesis seriously. For instance, there is no evidence for mirror self-recognition in children prior to one year of age. By the same token, although the search for extraterrestrial life and the technology available to do so is only in its infancy, the

accumulation of failed attempts with each passing day builds the case in favor of the absence of evidence.

Any discussion of extraterrestrial intelligence whether it is pro or con should acknowledge Carl Sagan as an outspoken proponent (Sagan, 1995). Since the Drake equation laid out a probabilistic argument for intelligent life beyond Earth (Drake, 1962), there have been numerous attempts to estimate the number of extraterrestrial life forms present in the Milky Way galaxy (Vakoch & Dowd, 2015) and there is wide disagreement about estimates for extraterrestrial intelligence (Golden 2021). A similarly large number of opinions exist when estimating the number of potentially life-bearing planets (Sandberg. 2018; Scarf & Cronin, 2016).

Despite continuous assessments prompting researchers to propose high estimates of extraterrestrial intelligent species (see Cai et al. 2021), and despite evidence of megalithic light-blocking structures orbiting a few stars in other solar systems (Horvat, 2015 Joseph & Duvall, 2021; Wright & Sigurdsson, 2016) there remains no proof to support any claims these were constructed by advanced alien civilizations (i.e., the Fermi paradox). Moreover, even with extensive and coordinated international efforts to scan space via Breakthrough Listen (see Price. 2021), no meaningful techno signatures have been detected beyond our solar system. Hence, recent arguments for the discovery of an extraterrestrial artifacts (Loeb, 2021; Oumuamua, 2021) are highly controversial and flawed (Cowie, 2021).

5. Extinction Events & Intelligent Life

If humans were to become extinct there is no compelling reason to expect that a similar form of intelligent life might re-emerge on this planet. Evolution does not occur by design; it occurs by natural selection, improving the probability of reproductive success. Each species has emerged via complex interactions involving genetic and fluctuating environmental conditions that add to stochastic changes in allele frequencies over time. These complex interactions make it unlikely that the same species might again evolve at some future date on this planet. The odds of similar interactions leading to the evolution of humans on another world may be infinitely remote.

Perhaps a more prudent explanation for the lack of any compelling evidence for extraterrestrial intelligence is that intelligent life commensurate with the intellectual abilities of humans is exceptionally rare (Carter, 1983; Mayer, 1995). Consistent with this view, recent analyses which incorporate the series of improbable steps required for the emergence of intelligence on Earth suggests that the amount of time for the evolutionary transitions required for intelligence to evolve (1 to 2 billion years) may exceed the habitable windows of many exoplanets (Synder-Beattie et al. 2021). Mars and Venus, for example, orbit within the habitable zone of our solar system; yet there is no evidence of intelligent life. Even if Mars and

Venus may have been habitable billions of years ago, and despite evidence supporting the possibility that algae, fungi, and lichens may have colonized the Red Planet (Armstrong, 2021a,ab; Bianciardi et al., 2021; Elewa, 2021; Joseph et al. 2020a,b; Latif et al. 2021), there is again no evidence of intelligent life.

Even if intelligent life evolved on other planets, they may have become extinct. Consider, again, that over 99% of complex eukaryotic life has become extinct. Estimates are that there have been five major extinctions, and with species continually evolving and becoming extinct. Again, consider the controversial evidence from Mars. Even if we grant that algae, fungi, lichens and simple metazoans evolved, there is no evidence of any progression leading to intelligence or "Martian" self-awareness. Earth may be the exception, and Mars may be typical of habitable planets throughout this and other galaxies, where life remains no more intelligent or complex than a mushroom.

Many believe that evolution lacks a conscious, intentional, deliberate component. Yet the process of evolution has paradoxically given rise to humans that are capable of conscious, intentional, deliberate acts – even those leading to the demise of other species and putting the existence of our own species at risk. Humans are not only unique in their capacity to apply a scientific approach to the reasons for their own existence, they are unique in their capacity to speculate about intelligent life here and elsewhere in the universe. They are also unique in that they have developed the technological capability to cause their own extinction.

Humans appear to be poised at the brink of reaching the tipping point when it comes to our dependence on fossil fuels and the resulting effects on climate change. The trajectory suggests that for the first time in the history of Earth, we are headed for a mass extinction that is occurring as a result of the actions of a single species; i.e., humans (Sampson & Roopnarine, 2001).

Will human cause their own extinction? If intelligent life, similar to humans evolved on other worlds, may they have caused their own extinction? Is this why there is no compelling evidence to support the hypothesis that intelligent life evolved on other worlds? Intelligence is not always adaptive and there is no propensity for intelligence to emerge or evolve in the first place; if it were, intelligent creatures would be the norm and not the exception.

6. Maybe Intelligent Extraterrestrial Life Does Not Want to be Found

Over a decade ago the famous astrophysicist, Professor Stephen Hawking raised and popularized concerns about the dangers posed by intelligent and hostile extraterrestrials who might arrive to conquer, enslave, destroy, and colonize humans to exploit the resources of our planet having exhausted those of their own. According to Hawking the outcome might be analogous to when Columbus came to America

which did not turn out well for Native Americans.

Another way to think about intelligent life elsewhere is that if it exists it may have found us by now and discovered that humans are dangerous, violent and ceaselessly engage in endless bloody conflicts and war, and continually develop even more powerful weapons of mass destruction. It would also be obvious, that as a byproduct of increasing pollution, habitat destruction, coupled with endless wars, pillage, death, destruction and the desire for conquest, that humans pose an unparalleled and unprecedented risk not only to other life forms on Earth but to life on other planets.

Consider the total destruction of the highly advanced Aztec and Inca civilizations, the subsequent enslavement and genocide of the native peoples, their temples and buildings destroyed, their wealth and natural resources stolen and shipped across the seas. If the humans of Earth became aware of advanced civilizations and desirable resources on other worlds, might these native extraterrestrial populations eventually suffer the same fate as befell the natives of Mexico and Peru?

If there is intelligent life elsewhere, they may view humans as extremely dangerous. Maybe this is why there is no proof or compelling evidence of extraterrestrial intelligence: we pose too great a risk, and they do not want to be discovered.

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