7-2019

"Where Is Everybody?" Fermi's Paradox, Evolution, and Sin

Noreen L. Herzfeld
College of Saint Benedict/Saint John's University, nherzfeld@csbsju.edu

“Where Is Everybody?” Fermi’s Paradox, Evolution, and Sin

Noreen Herzfeld

Abstract: The Search for Extra-Terrestrial Intelligence (SETI) project has been scanning the heavens for some sign of intelligent life for almost half a century. So far, nothing. This raises the famous question physicist Enrico Fermi is said to have asked, “Where is everybody?” The probability of intelligent life on another planet is high so why the great silence? Assuming evolution would work on other planets by the same mechanisms as on earth, it is likely that technological civilizations are short-lived. The mechanisms and timing of evolutionary development that lead to intelligent life and technological development also lead to the host of propensities we have traditionally labeled as sin and these propensities make it likely that few technological civilizations survive long enough to escape a technological bottleneck.

Keywords: Fermi, technological bottleneck, extra-terrestrial life, Niebuhr

On December 19, 2018, the NASA InSight lander placed a seismometer on Mars. This deployment marked a milestone—the first terrestrial instrument implanted on another planet. We humans have begun to colonize our solar system. A seismometer is a modest step; however, it opens the door to other instruments, ultimately, ones that could potentially mine Mars for raw materials and construct instruments of their own.

Why is this important? The Search for Extra-Terrestrial Intelligence (SETI) project has been scanning the heavens for a signal, some sign of intelligent life, for almost half a century. So far, nothing. Despite the claims of UFO enthusiasts, self-professed alien abductees, and supermarket tabloids, we have no evidence of any intelligent extra-terrestrial life. On statistical grounds, this is odd. After all, there are at least 100 billion galaxies in the observable universe. Our own relatively small Milky Way contains on the order of 100 billion stars. We now have located almost 4,000 planets orbiting stars in our galaxy, and this number represents only planets large enough for their gravitational pull to perturb the light of their star. Using an expanded version of an equation developed by Frank Drake in 1961, astronomers Frank and Sullivan recently concluded that the odds of our planet being the only one on which life evolved are somewhere in the vicinity of one in ten billion trillion (10^{-24}). Frank notes, “To me, this implies that other intelligent, technology producing species very likely have evolved before us. Think of it this way. Before our result you’d be considered a pessimist if you imagined the probability of evolving a civilization on a habitable planet were, say, one in a trillion. But even that guess, one chance in a trillion, implies that what has happened here on Earth with humanity has in fact happened about a 10 billion other times over cosmic history!”[1]

This raises the famous question physicist Enrico Fermi is said to have asked at a lunch discussion at Los Alamos Labs in 1951, namely, “Where is everybody?” If, indeed, the probability of intelligent life on another planet is so high, and if, as we have now shown, it’s quite possible for

a technologically based culture to leave the home planet, and if, as is likely, they could, at some point, produce self-replicating machines, then why the great silence? Someone, somewhere, should have by now colonized large portions of the galaxy, if not in person, at least with their machines.

Let's take a closer look at Drake's equation:

$$N = R * f_p * n_e * f_l * f_i * f_c * L$$

where:

N = the number of civilizations in the observable galaxy
R = the average rate of star formation in our galaxy
f_p = the fraction of those stars that have planets
n_e = the average number of planets that can potentially support life per star that has planets
f_l = the fraction of planets that actually develop life
f_i = the fraction of planets that develop intelligent life
f_c = the fraction of civilizations that develop a technology that releases detectable signs
L = the length of time such civilizations release detectable signals

The one variable, the value about which we have no idea, is L, the length of time a civilization might release detectable signals into space. How long might a technological civilization last? We have no scientific answer to this question given we have a sample size of one (our own) and no idea how long our own civilization will last.

While it cannot provide an answer to Fermi's question, I believe thinking about sin and evolution can give us some clues. Assuming evolution would work on other planets by the same mechanisms as here on earth, it is likely that technological civilizations are, sadly, short-lived. The mechanisms and timing of evolutionary development that lead to intelligent life and technological development seem, inevitably, to also lead to a host of propensities we have labeled as sin and these propensities make it likely that few technological civilizations survive long enough to seriously colonize much beyond their home planet.

The Technological Bottleneck

Futurist Nick Bostrom has noted that the great silence we observe means that technologically capable intelligent life is rare, if not unique. He suggests the existence of a "Great Filter," a step in evolution which is exceedingly difficult for life to transcend. According to Bostrom, "passing the critical points must be sufficiently improbable–that even with many billions of rolls of the dice, one ends up with nothing: no aliens, no spacecraft, no signals. At least, none that we can detect in our neck of the woods."[2]

This filter might occur early in the evolutionary process, as early as the development of life itself. Bostrom notes that experimental attempts to produce life in a laboratory have resulted in little more than a few amino acids. Ours may be the only planet with life. Bostrom hopes that this is indeed the case. But that is not a very interesting story. Let us suppose, instead, that life has indeed evolved on multiple planets. Would evolution on those planets be similar to our own? There is no reason to assume otherwise. We know of no other plausible mechanism than natural selection. Key properties that drive natural selection are fitness within an environment and competition for resources. We need also to consider the level and speed at which evolution functions. If Bostrom's "Great Filter" is ahead of us, then it is likely that we will encounter something other cultures have encountered—a technological bottleneck, a point at which technology outstripped their ability to control it. I believe it is precisely the key properties of evolution that make such a bottleneck likely. Or to adapt an Amish saying, "We grow too soon powerful and too late smart."[3]

Fitness and Environmental Degradation

The natural environment of an organism is the proving ground that selects for certain traits. Individuals that have a better fit with their environment have a better chance for survival and reproduction. Technology, broadly defined as the use and production of tools to alter one's environment, plays an interesting role in fitness. At first, technologies are remarkable at improving a species ability to cope with the dangers and difficulties a given environment might afford. For humans, the harnessing of fire, the development of tools for hunting and cooking, the design of better clothing and shelter, and finally, the development of agriculture, all allowed our species to flourish in number and expand our range. It is easy to think technology brings only advantages for the species that wields it. As Microsoft founder Bill Gates told world leaders at Davos, the world is continually "getting better." Advances in technology,

> have brought us to a high point in human welfare. We're really just at the beginning of this technology-driven revolution in what people can do for one another. In the coming decades, we'll have astonishing new abilities: better software, better diagnosis for illness, better cures, better education, better opportunities and more brilliant minds coming up with ideas that solve tough problems.[4]

But technology does not always alter the environment for the better. Species are hunted to extinction, agriculture depletes the soil, forests are decimated. Jared Diamond has chronicled several human societies that altered their environment beyond its capacity to rejuvenate in his monumental study, *Collapse*. Diamond notes that, "unintentional ecological suicide—ecocide—has been conformed by discoveries made in recent decades." He notes that process such deforestation, soil erosion, loss of water, overhunting, and population growth led these early societies to lose wars, famines, and loss of "some of the political, economic, and cultural complexity" they had previously developed.[5]

The collapse of Diamond's societies was local. The last survivors of Easter Island or the early Greenland colonies likely moved to other places where human society still flourished. A true technological bottleneck would demand a global collapse. Unfortunately, globalization has brought us to that point. Diamond writes:

> Globalization makes it impossible for modern societies to collapse in isolation, as did Easter Island and the Greenland Norse in the past. Any society in turmoil today, no matter how remote ... can cause trouble for prosperous societies on other continents and is also subject to their influence (whether helpful or destabilizing). For the first time in history, we face the risk of a global decline.[6]

Bill Joy, former CEO of Sun Microsystems, agrees. The advent of the nuclear bomb has taken our technologies to the point where the destruction they cause could be global in scale. Nor are nuclear weapons the sole threat. Joy warns that the convergence of robotics, genetic engineering, and nanotechnology could bring about the end human society altogether.[7] So might the continued burning of fossil fuels, accelerating global warming. None of these technologies would, of course, destroy our global environment on their own. They would need to be malevolently deployed, or, in the case of global warming, deployed without caution or forethought as to their long-term effects.

Competition and Sin

Diamond speculates as to what might have been going through the mind of the man who cut down the last tree on Easter Island.[8] Why do we cut down the last tree, hunt a species to extinction, or build weapons that might destroy ourselves? The problem is that evolution functions on an individual level. In other words, it selects individuals who show an advantage over their competitors and their comrades, thus inevitably introducing competition, both between species and within a species, where the fitness of one is raised or lowered by the fitness of the other.

Theologian Reinhold Niebuhr warns us of the pitfalls lurking in both interspecies and intraspecies competition, seeing both as setting up conditions that lead to behaviors we have labeled as sin. He notes Albrecht Ritschl's observation that humans experience themselves "as both a part of nature and a spiritual personality claiming to dominate nature."[9] The domination of nature is, of course, the first goal of technology and not bad in and of itself. However, Niebuhr notes that we find ourselves unable to avoid overreaching and disturbing the harmony of nature. Niebuhr ascribes this to our limited knowledge regarding the effects of our actions and our tendency to overestimate our capabilities. He notes that, "man is a finite spirit, lacking identity with the whole, but yet a spirit capable in some sense of envisaging the whole, so that he easily commits the error of imagining himself the whole which he envisages."[10] In order to develop an advanced technology, a species would have to have evolved this capacity of "envisaging the whole." However, such a capacity inevitably brings with it foreknowledge of mortality. This causes anxiety and dread, an anxiety that Niebuhr sees as "both the source of

creativity and the temptation to sin."[11] We seek to make our place in the environment ever more secure, inevitably by "seeking security at the expense of other life."[12]

Evolution also rewards those who reproduce the most. This leads to a second form of competition, not between species, but within a species. Thus, we turn our technologies against one another. Foreign policy analyst Martin van Creveld notes, "War and technology have always been linked very closely. Indeed, without technology, there would probably have been no war. After all, without technology, if only in the form of sticks and stones, man's ability to kill his own kind is extremely limited."[13] This link goes both ways. While technology has shaped war, so has war provided the impetus for the development of numerous technologies.

> From the first moment that *Homo sapiens* went to war, attempts were made to obtain victory by designing weapons that would be better than those of the enemy. Flint blades were replaced by copper ones. They in turn were replaced by bronze ones, which were replaced by iron ones, which were replaced by ones that were made of steel. Simple bows were replaced by long and composite ones, until finally firearms took over and did away with the bow altogether. . .[14]

Nor is war's influence as a driving factor in technological development limited to armaments. Transportation systems, new materials, radar, satellite and missile technology, computer technology, the Internet—all have been advanced primarily with military uses in mind. While it's possible to imagine the evolution of a species devoted to intraspecies harmony, it seems unlikely that such a species would be driven to develop the same sorts of technologies. Niebuhr is even more pessimistic. He notes that, while we as individuals are susceptible to the overreach of pride in our drive for dominance and security, "the pretensions and claims of a collective or social self exceed those of the individual ego. The group is more arrogant, hypocritical, self-centered and more ruthless in the pursuit of its ends than the individual."[15]

Thus, we engage in competition in two venues, between ourselves and the rest of nature and among ourselves, and on two levels, as individuals and as groups. We develop and deploy technologies to aid us in the battle and our battles, to a large extent, determine the shape of those technologies. As these technologies become more and more powerful and wider in scope, they become more and more dangerous. Nuclear weapons were the first "doomsday" technology humans invented, able to destroy our entire species. They will not be the last.

The Race Between Technological Development and the Evolution of Morality

Once a species reaches the level of having "doomsday" technology, the question is whether that species can refrain from using that technology. A species with multiple ways of destroying itself or its environment must have the wisdom not to do so. Essentially, there arises a race between the development of morality and the development of technology. If technology wins the culture loses.

Bill Joy, in his seminal article *Why the Future Does Not Need Us*, notes that we humans are in just such a race, on the cusp of a convergence of several disturbing technologies which we may not have the wisdom to control. He singles out genetic engineering, artificial intelligence, and nanotechnology and warns of a rapidly approaching crisis point:

> The 21st-century technologies—genetics, nanotechnology, and robotics (GNR)—are so powerful that they can spawn whole new classes of accidents and abuses. Most dangerously, for the first time, these accidents and abuses are widely within the reach of individuals or small groups. . . The last chance to assert control—the fail-safe point—is rapidly approaching . . ., The experiences of the atomic scientists clearly show the need to take personal responsibility, the danger that things will move too fast, and the way in which a process can take on a life of its own. We can, as they did, create insurmountable problems in almost no time flat.[16]

Have humans grown enough morally to handle these problems? Stephen Pinker certainly thinks so. In *The Better Angels of Our Nature* he argues that, two world wars notwithstanding, there has been a steep decline in violence in the last century and a worldwide increase in education, health care, longevity, and safety.[17] Might these mean that we will use our technologies wisely, ameliorating our existential anxiety and reaching a point where we can live and flourish alongside nature and each other?

Niebuhr considers this possibility. He writes, "there is no point in human history in which the human spirit is freed of natural necessity. But there is also no point at which the mind cannot transcend the given circumstances to imagine a more ultimate possibility. Thus, the conflicts of history need not be accepted as normative."[18] However, he also notes that "the Christian faith insists that the final consummation of history lies beyond the conditions of the temporal process."[19] Niebuhr is no utopian. He believes the competition, pride and greed that our existential anxieties give rise to are strong forces not easy to set more than temporarily aside and only overcome through grace, a "final supremacy of [God's] love over the forces of self-love which defy, for the moment, the inclusive harmony of all things."[20]

If We Find Them: Reason for Hope or Despair?

Nick Bostrom hopes we never hear from another planet. He concludes that this would point to the "Great Filter" being behind us, most likely at the beginning of life itself. If the filter is ahead of us, then the silence we have experienced so far makes it likely that most intelligent species go extinct before they develop the technologies that would let them colonize large parts of their galaxy. Bostrom sees no reason why we should not succumb to a similar fate. He assumes, "we have no reason to think that we will be any luckier than other species. If the "Great Filter" is ahead of us, we must relinquish all hope of ever colonizing the galaxy, and we

must fear that our adventure will end soon.[21] Thus he hopes we will find nothing but lifeless rocks, no matter how far we venture into our solar system or beyond.

I, however, have a different hope. Like Niebuhr, and despite fears to the contrary, I would like to think that the conflicts of human history need not be indicative of the future. Human culture has not only developed technologies. We have also developed religions. And while, like our technologies, we have too often deployed our religions in the service of competition and the vain quest for security, we have also deployed them in mutual cooperation and service to one another. Should we hear from another intelligent species it must have passed through the technological bottleneck, having acquired the wisdom and moral development that allowed them to surpass the drives of competition and live with "doomsday" technologies. Perhaps they could teach us a thing or two.

Should the skies remain silent, then we must either grow up rather quickly as a species or accept that transience is a part of life, not just for individuals, but for civilizations, for species, even, perhaps, for life itself. According to Niebuhr, "evil in the human situation arises . . . from the fact that men seek to deny or to escape prematurely from the uncertainties of history and to claim a freedom, a transcendence and an eternal and universal perspective which is not possible for finite creatures. The problem of sin . . .is the problem of life."[22] That problem may be insurmountable. But it might also be the case that our technologies will ease our anxieties, our religions will help us accept our finiteness, and that a new age lies ahead. Bostrom envisions, "the entire history of humankind to date [as] a mere instant compared with the eons that still lie before us. All the triumphs and tribulations of the millions of people who have walked the Earth since the ancient civilization of Mesopotamia would be like mere birth pangs in the delivery of a kind of life that hasn't yet begun."[23]

---

[1] Leonor Sierra, "Are we alone in the universe? Revisiting the Drake equation." NASA Exoplanet Exploration, May 19, 2016. https://exoplanets.nasa.gov/news/1350/are-we-alone-in-the-universe-revisiting-the-drake-equation/ . Accessed 12/24/18.

[2] Nick Bostrom, "Where Are They?" MIT Technology Review, April 22, 2008. https://www.technologyreview.com/s/409936/where-are-they/ Accessed 12/24/18.

[3] The original is "We grow too soon old and too late smart," the wisdom of which I can personally attest to.

[4] Bill Gates, A New Approach to Capitalism in the 21st Century." World Economic Forum, Davos, Switzerland, January 24, 2008. http://creativecapitalism.typepad.com/creative_capitalism/2008/06/bill-gates-crea.html

[5] Jared Diamond, Collapse: *How Societies Choose to Fail or Succeed* (New York: Viking, 2005), 6.

[6] *Ibid*., 23.

[7] Bill Joy, "Why the Future Doesn't *Need* Us," *Wired*, April 2000.

[8] Diamond, 114.

[9] Albrecht Ritschl, *The Christian Doctrine of Justification and Reconciliation* (Edenborough: T and T Clark, 1990), 199.

[10] Reinhold Niebuhr, *The Nature and Destiny of Man: A Christian Interpretation, Volume I: Human Nature* (New York: Scribner's, 1941), 181.

[11] *Ibid*., 185.

[12] *Ibid*., 182.

[13] Martin van Creveld, "War and Technology," Foreign Policy Institute, October 24, 2007. https://www.fpri.org/article/2007/10/war-technology-2/ . Accessed 1/14/19.
[14] Ibid.
[15] Niebuhr, *Nature*, 209.
[16] Joy.
[17] Stephen Pinker, *The Better Angels of our Nature: Why Violence has Declined* (New York: Viking, 2011).
[18] Reinhold Niebuhr, *The Nature and Destiny of Man: A Christian Interpretation, Volume II: Human Destiny* (New York: Scribner's, 1941), 3.
[19] Niebuhr, *Destiny*, 291.
[20] *Ibid*., 290.
[21] Bostrom.
[22] Niebuhr, *Destiny*, 3.
[23] Bostrom.