Science Fact

The Passenger Pigeon and the Great Filter

Howard V. Hendrix

In his article in the April 2019 issue of the *International Journal of Astrobiology*, "Implication of our technological species being first and early,"[1] astrophysicist and mathematician Daniel P. Whitmire invokes the principle of Copernican mediocrity and the "typicality" of our human situation to argue that the reason we have found no evidence of advanced technological civilizations in our Galaxy is "the typical technological species becomes extinct soon after attaining a modern technology and that this event results in the extinction of the planet's global biosphere." More recently, paleontologist and evolutionary biologist Henry Gee published an opinion piece in *Scientific American Online* (November 30, 2021) entitled "Humans Are Doomed to Go Extinct."

Neither Whitmire nor Gee are talking about cosmological events such as a giant space rock or gamma-ray burst blasting into us, or the sun bloating up into a red giant, or the heat death of the Universe. Neither are they talking about individual decisions on human extinction like those broached by Lee Edelman in *No Future: Queer Theory and the Death Drive*, or by the Voluntary Human Extinction Movement (VHEMT) promulgated by Les U. Knight, which encourages human beings to phase humanity out of existence by voluntarily ceasing to reproduce. The approaches of Whitmire and Gee lie between the individual and the cosmological, occupying the middle register of the social and technological.

Given that there are now a full eight billion of us *Homo sapiens* on this planet, the idea of a near-to mid-term extinction peril—to a species that in many ways is spectacularly successful—might seem a wee bit counterintuitive. There is a particularly fruitful analog, however. The Passenger Pigeon Precedent.

At the start of the nineteenth century, passenger pigeons (*Ectopistes migratorius*) were the most populous bird species in North America and probably the most populous bird species on Earth. Eyewitnesses to their enormous flocks passing overhead claimed those flights blotted out the sun for many hours, even days. Passenger pigeon roosting and breeding sites often covered hundreds of square miles and were referred to as "cities."

By 1914, there was only one surviving member of a species that had numbered in the billions not only one hundred years earlier but also for tens of thousands of years previously. That survivor was Martha, the last passenger pigeon who, with her deceased mate George, were thought to have been named for the first President and the first First Lady of the United States. When Martha (the pigeon) was found dead at the bottom of her cage at the Cincinnati Zoo on the morning of September 1, 1914, she was the last of the first—the last surviving member of the first species to be widely recognized as having become extinct due to human activities.

"For one species to mourn the death of another is a new thing under the sun," as Aldo Leopold put it in "On a Monument to the Pigeon" (1947). Cincinnati was my hometown, so the monument I am more familiar with is not the one in Wisconsin that Leopold writes about, but the small pagoda-style shrine of the Passenger Pigeon Memorial in the Cincinnati Zoo where, as a child, I first learned the meaning of the word "extinction."

In the zoo memorial, as in most other sources, the demise of the passenger pigeon is usually attributed to two causes. One is habitat loss, particularly the decline of nut- and fruit-bearing trees of the midwestern and eastern forests, cut down and burned to clear land for farming. The other and most cited cause, overhunting, took place on a scale so titanic it left a prominent trace in the English language.

Among many other tactics, pigeoners often tethered a decoy passenger pigeon, its eyelids sewn shut, to a tilting perch called a "stool." This perch, positioned just beyond the pigeon trapper's net, was fastened to long poles which, when raised and lowered, caused the temporarily blinded passenger pigeon to flap its wings, for balance. The wing-flapping emulated the behavior of a passenger pigeon landing to eat. This ruse caught the attention of passing flocks, which landed to investigate what the flapping pigeon had found. The trappers then sprung their nets on the curious birds, often taking and killing thousands of them in a matter of days. From these practices came the term "stool pigeon" for someone who betrays others by luring them in for the taking, or the kill.

The evolutionary survival strategy that these somewhat unpredictable migratory flocks had struck upon—and that had enabled them to thrive in such numbers—was *predator satiation*, in which the members of a prey species so flood a particular location with their numbers that their predators, far more thinly scattered on that ground, cannot possibly kill or eat them all. (Periodical cicadas, likewise found in eastern North America, employ this strategy as well.) Yet the passenger pigeon's demise was more than predator satiation meets insatiable predator. Overhunting and habitat loss are not the whole of the story.

Passenger pigeons were not only an extremely numerous but also a highly social species. As Joel Greenberg notes in *A Feathered River Across the Sky: The Passenger Pigeon's Flight to Extinction* (2014), "a widely held view is that this species could not sustain itself without a giant population." Jonathan Rosen notes in his *New Yorker* review of Greenberg's book (January 6, 2014) that the birds' "[population] decline itself became a cause of further decline. In other words, passenger pigeons lived by collaboration on a giant scale and may have died by it."

In "Natural selection shaped the rise and fall of passenger pigeon genomic diversity" (*Science*, November 17, 2017), Gemma Murray and her coauthors note that "although theory predicts that large populations will be more genetically diverse, passenger pigeon genetic diversity was surprisingly low"—much less than that of their nearest living relatives, band-tailed pigeons. Murray and her coauthors further note that "passenger pigeons' large population size appears to have allowed for faster adaptive evolution and removal of mutations, driving a huge loss in their neutral genetic diversity."

A hyperpopulous, hypersocial, hypersuccessful species of low genetic diversity—that might suddenly crash. Who else might that sound like? Us, perhaps. Humans. Whose genetic diversity is much lower than that of our nearest evolutionary relative, the chimpanzee. As Henry Gee notes, in terms of genetic variation *Homo sapiens* is "extraordinarily samey"—and "lack of genetic variation is never good for species survival."

Low genetic variation in a species is often attributed to its being a newer species (having recently arisen) or to population bottlenecks when the numbers of that species have crashed during the course of its history. Perhaps, however, our technological conquest of nature—changing the environment to adapt it to human needs, rather than human beings needing to adapt in response to environmental change—has (like the passenger pigeon's predator-satiation strategy) also allowed the vast multiplication of human population, while at the same time reducing the evolutionary selection pressures for human genetic diversity. Even more problematic, for a hyperpopulous humanity, might be the reduction in ideodiversity and behavioral diversity. When siloed people in the millions are seeing the same images, ideas, and behaviors algorithmically reproduced on their media feeds, we are perhaps setting ourselves up to be *Homogenized sapiens* while still very fractiously tribalized (see "narcissism of small differences")—and overdue for a hypersocial passenger pigeon-style collapse.

"Hyper" is at any rate the appropriate prefix, an idea emphasized in "Humans as a Hyperkeystone Species" (*Trends in Ecology and Evolution*, epub June 2016) by Boris Worm and Robert T. Paine. The idea of keystone species, "defined as organisms that have outsized ecological impacts relative to their biomass," was developed by Paine in the 1960s and is now a mainstream concept in ecology. In their 2016 article, however, Worm and Paine identify human beings "as a higher-order or 'hyperkeystone' species that drives complex interaction chains by affecting other keystone actors across different habitats. Strong indirect effects and a global reach further characterize these interactions and amplify the impacts of human activities on diverse ecosystems, from oceans to forests."

The interaction in North America between passenger pigeons and humans (of the European-descended geographical variant, not so much the indigenous) was just such a keystone/hyperkeystone chain. A hyperkeystone species is the keystone of keystones, the top of the top of the ecological pyramid. When conditions change, however, a previously successful strategy—predator satiation, say, or technological progress—can fail.

Fail how? In his essay Gee, after dismissing the Bomb ("nuclear annihilation has lost its imminence") and the Population Bomb ("As soon as 2100, the global [human] population size could be less than it is now"), not only goes on to discuss *H. sapiens* bottlenecks and near-extinctions in the context of genetic variation mentioned earlier, but also much else. He glances at lower birthrates resulting from sperm quality collapse due to endocrine-disruptive pollution or to urban population-density stress, or perhaps both. He also examines birthrate declines traceable to the improved status of women, including better education, contraception, and demographic transition.

Beyond birthrate issues, there's also the human sequestering of *net primary productivity*—the net carbon gain by vegetation over a given time, the balance between the carbon gained via photosynthesis and the carbon released by plant respiration. As Fridolin Krausmann and coauthors note in "Global human appropriation of net primary productivity doubled in the 20th Century" (*PNAS* June 2013), our appropriating the productive capacity of the land into "harvesting and burning biomass and converting natural ecosystems to managed lands with lower productivity" eventually brings along with it a related decline of longer-term economic productivity and environmental quality overall.

In contrast to Gee's downplaying of (over)population issues, his linked sources in Krausmann argue that "Global increases in population, consumption, and gross domestic product raise concerns about the sustainability of the current and future use of natural resources." Heinz Schandl and coauthors argue that despite the fact that "global population growth has slowed and global economic growth has stalled" over the last twenty years, "a global surge in material extraction has been driven by growing wealth and consumption and accelerating trade" ("Global Material Flows and Resource Productivity: Forty Years of Evidence," *Journal of Industrial Ecology*, June 30, 2017).

Running up the charges on our global credit card, we are a debtor species in many ways, not least in terms of extinction debt involving not only other species but potentially also our own. David Tilman and coauthors define that debt as being "a future ecological cost" of current habitat degradation and loss ("Habitat destruction and the extinction debt," *Nature*, September 1, 1994). The fact that we are the primary "vector" for the ongoing sixth great mass extinction—the only such palimpsestic planetary episode caused by a particular species rather than by geological or cosmological events—also raises the possibility that, as the biosphere degrades, our species is more likely to become a *victim* of that mass extinction as well.

For all these reasons, even setting aside "Bombs" both nuclear and overpopulational, Gee argues we will see a high boom followed by a sharp bust: Not just human population shrinkage, but instead human population collapse ("and soon") followed by human extinction. Whitmire's findings coincide with Gee's arguments on the parameters of species longevity. The likely inference arising from his research, Whitmire suggests, is that "the typical technological species has a short lifetime." In arguing that the extinction of technological species "coincides with the extinction of their planetary biosphere," however, Whitmire posits a broader stage of action than does Gee.

Whitmire's work is important to our understanding of what Robin Hanson called the "Great Filter." This idea comes out of the context created by the Fermi Paradox: In a universe that should be replete with life (presumably some of it intelligent), where is everybody? Why have we found no evidence of alien technology or extraterrestrial life? Why are no ETs phoning us? To help explain this puzzling situation, Hanson's Great Filter theory proposes a series of cosmological, biological, and technological hurdles that must be cleared before an advanced spacefaring civilization can come into existence.

Remembering always that absence of evidence is not necessarily evidence of absence, we can nonetheless affirm that the absence of evidence for the existence of advanced spacefaring civilizations at least suggests the possibility that no species has cleared every one of those developmental hurdles described by Hanson. Under this theory, the slow rollout of a far more widespread extinction appears to be underway. All species in our Galaxy so far appear to have been "filtered out"—gone extinct—before achieving advanced spacefaring status.

In contrast to Gee's somewhat more social and biological emphasis, Whitmire focuses heavily on technology and the idea that the Great Filter might well be a consequence of technology itself. Based on his understanding of the Copernican principle and the typicality of our situation, Whitmire asserts that "the implication of being the first technological species on a planet is that there are typically no subsequent technological species," and that the extinction of the "first generation" of a technological hyperkeystone species on a given world "coincides with the extinction of the global biosphere"—even if the species itself had already been in existence for hundreds of thousands or millions of years.

More narrowly, Jacob Haqq-Misra and coauthors (in "Observational Constraints on the Great Filter," *Astrobiology,* 2020) suggest that we should be "searching for technosignatures alongside biosignatures"—evidence not only of biological activity but also technological activity in, for instance, spectrographic studies of exoplanet atmospheres. Looking at both types of signatures, the authors contend, could provide important knowledge about the future of our *own* civilization. As Haqq-Misra and his coauthors put it, "If planets with technosignatures are abundant, then we can increase our confidence that the Great Filter is in the past. On the other hand, if we find that life is commonplace while technosignatures are absent, then this would increase the likelihood that the Great Filter lies in the future." The latter scenario is the "Bridge Out" sign for extinction ahead.

Hyperkeystone species, meet Great Filter? During the course of our development, *H. sapiens* has not always met the criteria Worm and Paine define as "hyperkeystone." When did *we* become that—and how? What is fundamentally required for a species to be a hyperkeystone? A particular level of conscious awareness? A certain level of technological prowess? Can a hyperkeystone species become a keystone too heavy for not only its own ecological arch but, as the keystone of keystones, too heavy for *any* of those arches? Can a hyperkeystone species kill its own biosphere? *Must* it do so?

There is, however, another possible interpretation of that "Bridge Out" scenario of commonplace-life-but-absent-technosignatures. Science fiction novelist Arthur C. Clarke famously wrote that "Any sufficiently advanced technology is indistinguishable from magic." But what is the technosignature of *magic*? When we look for what we recognize as technologically-generated traces in planetary atmospheres, we are essentially looking not for aliens but for ourselves among the stars—same types of technologies, same atmospheric traces. In doing so we risk reducing our telescopes to *nothing but* mirrors, in which we hope to see ourselves reflected.

Recognizing the potentially biosphere-killing trajectory of their technologies and the accompanying likely extinction of their technological civilizations, species like our own, with similar pretensions to higher dimensions, may perhaps have evolved beyond technological civilization as we know it. Would their higher technologies even look like technologies to us, or instead like transcendent post-technological higher magic—or higher consciousness, or higher simulation? What if their "radio silence" stems from the fact that, faced with the choice of extinction or transcendence, they chose the latter and have disappeared into some nirvana of higher dimensions or realer simulations? What if, to get where they've gotten to, you don't need starships?

Wonderful possibilities, no doubt, but transcendence (to the extent that it involves a disappearance from a particular plane of existence) is also a kind of extinction, in its way. Finding the transcended *them* by their magicosignatures of synchronicity and quantum-entangled "laws of contact" might well be more challenging than just finding another version of *us*. And if what *they* achieved was not so much transcendence alone as a combination of transcendence and immanence, a transmanence of a celestial bodhisattva's sort, an evolutionary "going beyond by remaining within"—they could very well already be hiding in plain sight.

Such technobodhisattvas, having avoided extinction and chosen out of compassion to refrain (or not refrain) from creating further simulated realities, would be once-and-future species quite a bit different from those proposed by the de-extinctioners, who hope to resurrect, among other ghost creatures, the passenger pigeon (but not its environment, unfortunately) from genomes pulled out of museum specimens.

However, as John Muir put it, "When we try to pick out anything by itself, we find it hitched to everything else in the universe." If, on some distant day, a program (overseen perhaps by our robotic inheritors) switched on for the purpose of reconstructing latter-day humans from their preserved genomes, that project would likely face the same problem of lost environmental context that faces the resurrection of the passenger pigeon—especially if the collapse of the planetary biosphere proves to have been entangled with that human extinction.

(Another variant of the lost context issue also surfaces here, in the suggestion that one way to get around the Great Filter is by positing that we already live in an intergalactic human civilization's Bostromian simulation, one *ad hoc* optimized to render only what is being observed. In such a scenario we are the product of a future "us" running simulations of its past, so the Great Filter is inherently already in their—and perhaps also our—past.)

The conjoint consideration of the passenger pigeon and the Great Filter suggests that neither human extinction nor posthuman transcendence in the near-to mid-term is utterly improbable nor absolutely inevitable. It also suggests, however, that the concept of the future as just a technologically enhanced, 2.0 version of the present is radically incomplete and potentially disastrous. We must do more than simply contemplate the similarities and differences between stool pigeons with their eyes sewn shut and 'net influencers wearing VR headsets.

Let's hope that, for our own hyperkeystone species, in the longer term the most appropriate descriptor will prove to be not only "higher technological level" but also "higher conscious awareness"—and that, in this fuller contextual awareness of our situation, we may find the key to a species survival plan for *Homo sapiens* and for Earth's biosphere as a whole.

Endnote:

[1] Original paper published online by Cambridge University Press October 2018, referencing a previous paper published in *International Journal of Astrobiology* August 2017. https://www.cambridge.org/core/journals/international-journal-of-astrobiology/article/implication-of-our-technological-species-being-first-and-early-the-anthropic-selection-effect-of-our-technological-youth/856259A4F50B0E3D3B7BE8654C6EC5F6