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Zombie Epistemology: Or, I Ain't Gonna Work on Zoltan's Farm, Either

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Authors Note: A Spotify playlist for songs cited in the paper can be accessed at https://spoti.fi/3i9ovKR. I am grateful for suggestions by Stacy Lynch.

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Zombie movies express for us the horror that would take place if the dead did not go away so that the living could pursue existence unimpeded by the dead hand of history. The horror is an inversion of the desire to be reunited with lost loved ones, as the dead's bodies are restored without their minds. As the title track to the soundtrack for Jim Jarmusch's *The Dead Don't Die* puts it (Simpson 2019a):

> Hearts break when loved ones journey on
> At the thought that they're now forever gone
> So we tell ourselves they're all still around us all the time
> Gone but not forgotten, just memories left behind

Zombies also represent to us the living who act as if they are dead, whether because they follow the crowd, continue to fight old battles mindlessly, or obey orders from corrupt political leaders without question (O'Riordan 1994; Kuti 2009).

As in so many cases where we attribute brain-dead stubbornness to those who won't get on board with what we want them to do, accusations that someone is a zombie can stereotype a difference in values. So the same songwriter from *The Dead Don't Die*, in "Living the Dream," objects to being party to anyone else's plans for him: "I don't have to do a Goddamn thing except sit around and wait to die" (Simpson 2014). In his 2019 book, *Nietzschean Meditations: Untimely Thoughts at the Dawn of the Transhuman Era,* Steve Fuller complains precisely about this kind of sentiment among those who refuse to embrace transhumanism and the quest for longevity and immortality, or more generally object to repaying their debt to society by contributing to a future, collective human project (Fuller 2019, 149, 171-72; compare Graeber 2011).

Fuller warns his fellow transhumanists that they have a zombie problem, something that may interfere with their own plans for an upgraded future:

> These are people who live in the space of their largely self-imposed limitations, which function as a self-fulfilling prophecy. They are programmed for destruction – not genetically but intellectually. Someone of a more dramatic turn of mind would say that they are suicide bombers trying to manufacture a climate of terror in humanity's existential horizons. They roam the Earth as death-waiting-to-happen. This much is clear: If you're a transhumanist, ordinary people are zombies (2019, 197-98).

The transhumanists need to compel us zombies to get off our asses and help make possible the work that's needed to allow us, for instance, to upload our consciousness to digital computers to avoid death. Not all of us want to, as "Living the Dream" makes clear, perhaps reflecting the inherent laziness of the biological human body and a reaction to the demands placed on these bodies by capitalism and responsibility to family (Fernández-Aráoz 2020; Coleman 2005). Fuller (2019, 89) construes the concept of humanity as inherently connected to efforts to transcend its embodiment, worrying that digital uploads may usurp the

"evolutionary vanguard" from *Homo sapiens* in the narrow sense, leaving us behind like zoo animals "brought back down to their biological natures." Bodies are bad, bur constantly looking to upgrade your form ("morphological freedom") is good.

The problem with zombies is that we just have bad ideas about the future that Fuller wants to fix. If the ideas can be fixed, the transhumanists can avoid the necessity of either running from or annihilating zombies. What kind of bad ideas do the zombies have? Fuller (2019, 117) provides a list:

> 1. They believe that they will live no more than 100 years and quite possibly much less.
>
> 2. They believe that this limited longevity is not only natural but also desirable, both for themselves and everyone else.
>
> 3. They believe that the bigger the change, the more likely the resulting harms will outweigh the benefits.
>
> 4. They believe that a 'digital afterlife', however understood, is ultimately a delusional denial of death.

Fuller's "humane" solution for enlisting us zombies in the greater glory of a species-wide project to advance our humanity to the next level is explicitly modeled on the civilizing mission of imperialism, or, as it's called now, development (2019, 199). Fuller's view of colonialism and post-colonialism is terribly sanitized, one might say white-washed, with its failures attributed to the lack of will by the colonizers to carry forward with the spending needed to realize the "gift" being offered to underdeveloped countries, doubling their life expectancies if only they would accept it (35, 199; compare also Fuller 2013; Escobar 1995; Estes and Dunbar-Ortiz 2020; Roy and Sejpal 2019).

Setting aside the horrors visited upon the lucky recipients of colonialism 1.0, and the likely horrors of a full-on program for colonialism 2.0 (aka transhumanism), let's look closely at the beliefs attributed to the zombies.

1. They believe that they will live no more than 100 years and quite possibly much less.

This is probably true, but not inevitably so, for the near-term future, because the 21st century will continue to be a challenging century. Whatever the progress of modern medicine and public health initiatives, collapsing or declining civilizations could lead to partial reversals of the demographic transitions that extended our lifespans in the first place (Todd 2003). This is why one zombie program is to transition to environmental and political sustainability, which would certainly require some kind of precautionary principle for emerging threats caused by new technologies, capitalist development, and associated social change.

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Zombies might be doing the work of preventing a regression to *shorter* lives, with consequent shorter time horizons, which will impede any kind of long-term thinking for humanity. Fast lives from living in stressful, violent, and unhealthy environments lower perceived or "subjective" life expectancy, and consequently willingness to plan for the longer term (Mirowsky and Ross 2000; van Solinge and Henkens 2017; Bestion et al. 2015; Fuller 2019, 158-59; Carroll 1980).

Of course, to fully solve the problems associated with ensuring a sustainable technological civilization, to *actually* carry out precaution, one will need quite the proactionary social movement and innovative knowledge practices to avoid civilizational collapse or worse (76-78). This is because modern, industrial society depends upon a temporary boom based on fossil fuels that may not be replaceable by any new energy sources capable of supporting current or projected population levels and resource use. One can certainly hope that magical solutions will be forthcoming, but the faith in markets to automatically provide technological solutions to resource scarcity no matter what has got to be one of the more deranged pieces of faith of the modern, neoliberal cant, one I don't believe Fuller shares (2019, 83).

Fuller is closer to being transhumanism's Lenin in seeing the need for a revolutionary *avant garde* to act quickly to exploit an open, but potentially revolutionary, situation before the ruling class (or the zombie class) has a chance to close ranks. On this view, Marxist historical necessity was a noble lie to encourage the masses, a double truth model for communism. Failing a magic trick of a new source of power for industrial society, the possibility of a transhumanist future depends upon first solving the challenges to our existence and ensuring a sustained capacity for further adaptation available in a sustainable technoscientific infrastructure in this century.

2. They believe that this limited longevity is not only natural but also desirable, both for themselves and everyone else.

Well, limited longevity is certainly natural in the sense that death is biologically programmed, though it can be tinkered with to some extent. The debates about death as an evolutionary adaptation reflecting somatic-germ conflict make interesting reading in this regard. A real life zombie tale, the continued existence of the worn out body is a burden the immortal gene does not wish to continue supporting (Heininger 2002). Recall that the original proposed title for Dawkins' *The Selfish Gene* was "The Immortal Gene," as our bodies are simply carriers of genes that continue to be propagated through generations (Dawkins 1976). Here it is transhumanism itself that evokes one type of Zombie story, the unnatural prolongation of life through dark magic for the purposes of raising a zombie army for nefarious purposes (Creaux 1968).

Limited longevity is also a function of natural limits in the sense that we exist within a food web that has solar limits, supplemented partially by fossil fuel inputs to agricultural production, something limited here on earth (Sierferle 2001). Smill (2001) demonstrates that increased agricultural production based upon the Haber-Bosch process, dependent on fossil fuels, is responsible for the very existence of almost half the human life on earth, as well as

the enhanced lifestyles of the wealthier countries. The exploitation of these resources is *less* energy efficient, even if more labor efficient, and increases our ecological footprint, though that may be disguised by off-site extraction of oil and factory-farming (Pimentel and Pimentel 2007; compare Fuller 2019, 38-39, 69-70). The idea of colonizing other planets and terraforming them, so that we may continue to enjoy a boon of energy and material resources, has challenges that are so insuperable that it is hard to see how this can be a plausible solution.

Space exploration is a great idea for other reasons, including "calibrating" our place in the universe by determining if other forms of life and intelligence exist (Sagan 2006). Space travel is less likely to yield results, however, than communication by radio signals or other forms of energy that can be detected long after the source has stopped transmitting and don't require massive amounts of energy and time on our part to detect. As it relates to manned space travel, or even timely use of unmanned probes, natural limits are natural limits, no matter how impatient one is with small-minded people who point them out. A few follow from one equation, $E = mc^2$. Start first with c, the constant speed of light in a vacuum. This puts a speed limit on space exploration that would be quite significant, even for nearby star systems.

Once you factor in the energy requirements for getting close to the speed of light, the situation looks absolutely impossible. Our current unmanned probes on the edges of our solar system would take 80,000 years to reach the closest star system, Proxima Centauri, about four light-years away. Very small, postage-sized, unmanned probes with sails powered by lasers, dodging space debris, might allow speeds of 10% of the speed of light, allowing a forty year trip to Proxima Centauri to take pictures to be sent back via very weak transmissions (Wall 2018, 2019).

Manned ships, especially to more far-flung destinations, look absolutely daunting, even given an optimistic view of our capability of solving merely the known challenges, especially given the extreme biological, ecological, and sociological challenges of space travel (Nelson 2018; Wohlforth and Hendrix 2016; Nilssonn 1972; Taupin and John 1971; Cauthen 2018). Even a manned mission to Mars would require that astronauts survive on Mars for 500 days until the earth and Mars' orbits become aligned again, which would require massive infrastructural transformation of Mars to support the astronauts, which would require prior massive transfer of material and labor (Achenbach 2019). Unknown unknowns of interstellar exploration are likely to be even more challenging. One might infer from the lack of clear evidence of alien visitation that we have been separated from other intelligent life forms in the infinite wisdom of the good Lord, or the inflationary multiverse, or what have you. Unless, of course … checking the index for Roswell … well, no, probably not (Craig 1995; Wendt and Duvall 2008; McGuinn 1967; Greenwood et al. 1997).

Do most of us zombies think the current lifespan is desirable? No, not really. Here it is the atheists and agnostics that are on point, as they are the ones not banking on a personal afterlife. Some do console themselves with some good tricks for ignoring the horrors of personal mortality, most dating to the ancient Stoics (Harris 2014; Becker 1998; compare

Seneca's *imago vitae suae* to Fuller's (2019, 19-20, 140-42) discussion of a digital afterlife through a carefully scripted social media legacy).

Others, however, have seen this as signifying the absurdity of the universe, as the universe seemingly pays no mind to how we feel about existence and its opposite (Lovecraft 2017, with its warnings for intrepid travellers; Veit 2018; Camus 1961: compare Fuller 2019, 14, 139-40). If human consciousness, knowledge, and identity cannot be specified apart from a fragile web of relations with the non-human world, as new ecological materialisms and object-oriented ontologies posit, the entire focus on *transcending* natural limitations that hold us back seems misconstrued (Johnson 2016). The transhuman, no less than the human, cannot be accomplished by "escaping or repressing not just its animal origins in nature, the biological, the evolutionary, but more generally by transcending the bonds of materiality and embodiment altogether," such that "transhumanism should be seen as an *intensification* of humanism" that shares its "fantasies of disembodiment and autonomy" (Wolfe 2009, xv; compare Fuller 2014).

This certainly makes sense given that the universe as a whole appears to be not alive, not conscious, and unaware of its finite existence, while we are. Certainly, many are working on loopholes for this, perhaps by postulating that life is intrinsic to the universe rather than a contingent, emergent structure or that we will all be revived in the end by a singularity (Morris 2003; Hinzen 2005; Goodwin 1994; Russell 2001; Tipler, Graber, McGinley, et al. 2007). Fuller (2019, 81) sees transhumanism as promising "the reversal of the second law of thermodynamics that will result as mind finally comes to conquer matter."

If there is one trend in modern cosmology (not to mention the science of complexity), however, it is the growing centrality of the second law, defining the arrow of time, absent from general relativity and quantum mechanics. Stephen Hawking initially was comfortable with violations of the law in his treatment of black holes, but efforts by Jacob Beckenstein to apply the law to black holes led Hacking to develop his account of Hawking radiation and develop its implications for Big Bang cosmology. Human life seems to be intimately connected to the arrow of time, as we are an especially extended, but not infinite, case of irreversible processes, like "the bullet from a gun." (Clark 2018; Penrose 2004, ch. 27; Carroll 2017; Brennan and Waits 2011). Banking on reversing entropy, while construing mind as the opposite of matter, rather than a special state of matter, seems foolhardy.

But, after all, it is Fuller (1989) who long ago told us that humans were especially fallible creatures subject to wishful thinking and motivated reasoning. It may be that the twenty-first century ideological struggle is not between transhumanist Ubërmensch and recalcitrant zombies, but between those who are willing to face our existential plight as we gain knowledge of our contingent and dependent existence and those who would either ignore it with comforting tales of metaphysical security or who are driven mad by this knowledge (Johnson 2016, 102-103; Gray 2014; Hume 2007, 38-39; Nietzsche 1998, 11-15).

3. They believe that the bigger the change, the more likely the resulting harms will outweigh the benefits.

Speaking for many of us zombies, if not the majority, we have been calling for a quite drastic change in the way things work lumped under the category of calls for political revolution or even, terror of terrors, socialism. But these are routinely pushed aside as nostalgic and unrealistic aspirations, including from transhumanists whose aspirations and goals are beyond any measure of ordinary hubris. One suspects they think it is easier to take "possession over judgment day" (Johnson 1937) than to arrange society a little differently so that the benefits of industrial civilization are shared more equitably and sustainably with the population as a whole (Fuller 2019, 30).

If transhumanists have a zombie problem, then environmentalists and socialists have a transhumanist—or maybe, techno-libertarian—problem. So many people are waiting around for technology to liberate them from their biological and planetary chains, that insufficient work is being done to ensure that we make the kind of transitions towards sustainable energy and resource use, and stable and more just political economy, in the twenty-first century that will allow our civilization to "live long and prosper" (Scott-Heron 1970). It may be useful here to point out to transhumanists that programs for space exploration and a sustained technological civilization capable of making whatever progress is possible towards their long-term goals, depends upon first solving these challenges (Bostrom 2002), despite the perceived urgency of seeking *personal* immortality (here Fuller 2019, 139, 78-79, 150-4, 188-90, does provides useful perspective on Zoltan's neurotic, fear-based "necropolitics" and Bostrom's fixation on the danger of extinction at the hands of artificial intelligent machines created by us).

I would argue that our experience with threats to our own existence brought about by our very success as a technological species testifies to the likelihood that technological civilizations capable of communicating with, and possibly meeting us, are small in number, maybe zero. Sustainable technological civilizations may be sufficiently rare as to constitute the "great filter" that explains the Fermi paradox (call it the "shortness of extraterrestrial life," following Seneca). The Fermi paradox points to the apparent absence of detectable life in the universe apart from our planet's, which suggests that at some stage life, or intelligent life, becomes derailed. The difficulty of transitioning from a technological society fueled by a temporary availability of fossil fuel without destroying itself through nuclear war, environmental devastation, or destructive climate change could be the main reason we can't at least communicate with extraplanetary, intelligent life (Hanson 1998; Breit et al. 2005; Moore 1970).

4. They believe that a 'digital afterlife', however understood, is ultimately a delusional denial of death.

This one certainly seems delusional, though perhaps understandable given one of the core metaphors we live by in the modern world: intelligence as an information processor, a kind of software that is indifferent to its hardware, hence transferrable to different kinds of more

permanent machines. I blame Gene Roddenberry here, or maybe J.D. Bernal (Bernal 1969; Midgley 1992; see Fuller 2019, 29-30, for discussion of the implicit role of Russian Cosmism in the Soviet Union's space program). Certainly transporters push Humean identity to its limits, but the dream of Artificial Intelligence, that digital computers will become sentient at some specified level of complexity, depends upon a widely shared, but fatally flawed, computationalist view of intelligence (compare Dennett 1998 and Deacon 2012). If we are to have a digital afterlife, it must also be possible to transfer this intelligence as a purely formal "software" from its biological hardware to a digital one. This is yet another case where we have been taken in by a metaphor for intelligence based upon current technology (Zarkadakēs 2016).

Virtually every part of point four is wrong. We are not information processors, the brain is not a computer, and intelligence is not a software program (Hendriks-Jansen 1996; Crawford 2021). We can be cyborgs, but that's a different thing, and not quite the kind of thing that we often think it is. We extend our powers through technology because our biological endowments allow us to learn to see tools as extensions of our own body, which is not quite the same as fusing with the machine (Clark 2003; Taylor 2010; Fuller 2021; Balin 1967). It's worth noting, as an aside, that we are also all equipped to extend our perception through greater and greater social complexity, itself mediated by technology, facilitated by our biologically evolved capacity to transmit culture, which facilitates group selection and cultural evolution in a way that no other species on earth can approach (Henrich 2016). We do so my remaking our niche in ways which allow us to select for new kinds of behavior, as a "work around" of our evolved sociability and, only later, potentially, as new biological traits (Richardson and Boyd 2000; Rendell, Fogarty, and Laland 2011; Laland and Brown 2006). This imperfect and constrained process does not work by fusing with a collective or a machine like the Borg (there's Roddenberry's diffuse influence again; compare Fuller 2019, 96-97).

Schrödinger (1944) first showed that life, and presumably consciousness, emerges from an infusion of energy that temporarily holds off entropy. The analysis of far-from-equilibrium thermodynamics provides the underlying physical basis for understanding how biological "information" can emerge from a universe of matter and energy. In contrast to views that see information suffused throughout the universe from the start (Meyer 2009), we know that life, and mechanisms supporting it like DNA or neuronal activity, depend upon a continuous supply of energy that allows information to be transmitted within an energetic system, "hiding" it from entropy for as long as possible (Hidalgo 2015; Prigogine 1961).

England (2020) summarizes recent work on how configurations of matter explore the range of options available in ways that can adapt themselves to energetic inputs, minimizing and directing energy flows in a manner that preserves emerging complex structures. These dissipative adaptations show how certain behaviors of non-living matter exist on a continuum with living matter. Non-equilibrium thermodynamics and the science of complex systems show how adaptive structures can form prior to, and set the stage for, the emergence of formal Darwinian evolution in a way that mimics predictive computer systems.

Information, on this view, would not exist within the universe until such far-from-equilibrium processes could establish themselves. Any kind of calculation is a physical process, an irreversible one generating entropy in the form of heat energy (Davies 2019). Moreover, the information would not be meaningful to the universe as a whole but only to beneficiaries of this emergent property (Maynard Smith and Szathmáry 1995; Calcott and Sterelny 2011; Jablonka and Lamb 2006, 237). The operations of a computer can be described based upon physical laws describing how its component parts work, with information included as part of the physical system. It doesn't need to know how we are using it for the transmission of information useful to us.

The *interpretation* of the resulting output of a computer as meaningful depends upon individuals and practices that can make use of the output in light of constructed languages, binary or higher-order (Edwards 1996, 244-52). Even selfish gene proponents miss this point when they argue that well-defined units of information called genes act as replicators, independent of vehicles that merely carry the information to the next generation (compare Dawkins 1973 with Keller 2002; Jablonka and Lamb 2005). In short, the transmission of information cannot be isolated from the environment that gives rise to it (Lewontin 1983). Information is always information that's identifiable only within the context of developmental and cellular systems that can read it as such (Oyama 1985; Griffiths and Gray 2004; Davies 2019, 64-66).

Preserving our genetic code without the reproducing bodies that encode it would be like trying to play a VCR tape without a VCR, or more precisely, without a VCR player, compatible television, electrical outlet and transmission system, and power source. Future humans might be able to crack the code but would need to recreate the right kind of machine for reading it. The situation is worse for biological machines. We might be able to extract DNA from frozen mammoths, for instance, inserting it into modern elephant cells *in vitro*, reverse engineering mammoth traits from elephants that share 99% of their genes, or gene editing an existing elephant. But we cannot just take the digital information and recreate mammoths from a machine, like Star Trek's replicators, that make it from scratch (there's Roddenberry misleading us again, iPads and cell phones notwithstanding) (Shapiro 2015; Fuller 2019, 172).

Barring some kind of mechanism that replicates the developmental-reproductive system that constitutes a lineage, this isn't going to happen. Such a mechanism would almost certainly be a biological, "wet" machine of some kind, and not a digital computer attached to a 3-D printer (Chemero 2009; Fuller 2019, 155). Perhaps more to the point as it relates to the quest for personal immortality, a mammoth clone would be an (almost) identical twin to the original mammoth, not a continuation of the original living being.

The same point would apply to digital copies of our minds, even if we were to concede that such copies were conscious or intelligent. Just as with the dream of cryonics, keeping bodies or heads alive for generations until we are capable of reviving consciousness, the mere feasibility of the revival process is not the worst of it (Fuller 2019, 156). More crucial is the political economy and infrastructure necessary for such a project to work, a point Fuller

(2019, 89-90, 96, 158-59) recognizes in arguing that brain-computer interfaces may be more efficient than reliance upon fully digital AI. Who is going to be providing the energy to run the revived bodies or digital copies? Who will maintain and repair the system? If we think about our experience with recording technologies, we can see that digital lifetimes are on average *shorter* than our own and can't be made substantially longer unless we can command entire future economies and labor to carry this out.

Assuming that we can avoid one system crash, one equivalent of the blue screen of death over millennia, who will do the work and why? Imagining an army of AI-enhanced robots doesn't solve this problem, but defers it, as resources and labor are needed to maintain these as well. Digital afterlife founders on the myth that computer and information technologies tend towards dematerialization (Hornborg 2012). Modern understanding of thermodynamic processes "clarify the physical nature of information, so that it enters the second law not as an abstraction, but as a physical entity. In this way, information manipulations such as measurement, erasure, copying and feedback can be thought of as physical operations with thermodynamic costs" (Parrondo, Horowitz, and Sagawa 2015). If today's ruling class must scheme constantly to ensure compliance from the global working class, how much harder will this be for tycoons preserving their bodies or minds who need to compel future labor pools to do their bidding? What do they think future generations will do with their reanimated heads? (Lovecraft 1922; Kleier 1928; Lamba, Holsgrove, and Broekman 2016; Erickson 1975).

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Fuller's work on transhumanism is interesting because it forces us to think about the long-term trajectory of the human species and the knowledge and technology it is likely to build in the future. He is surely right that the challenges posed by twentieth-century problems have overwhelmed the optimistic projections of the future that led the way mid-century, as a simple extrapolation based on what now look like exceptional and temporary rates of economic growth and technological innovation encouraged fevered dreams (Mühlbauer 2006). As the gloom of dealing with an emerging awareness of a troubled Anthropocene, likely to be a thin stratum for future archaeologists rather than a long-lived geological epoch if we are not careful, our imaginations have contracted, and possibly deadened. We have become zombies just seeking out bare survival without conscious thought and planning.

At the same time, we should recognize that the kinds of dreams we had about technologically-mediated transcendence were part of the problem. The idea that the earth, or our bodies or brains, are disposable such that we can move on to the next one was part of the problem. By considering transhumanism's zombie problem, Fuller is trying to get beyond self-imposed obstacles to putting together a collective plan for where we are headed rather than where we have been. But where we have been shapes what can be possible, even though these possibilities can be reworked. The idea of an evolutionary preadaptation, or exaptation as Gould and Vrba (1982) put it, is relevant here. It is because we have minds and bodies adapted to Pleistocene problems that we can be the kind of species that, with the right kind of cultural work-arounds, can construct kinds of knowledge, signs, technologies,

and social systems that have made remarkable progress in developing new kinds of environments that will shape our future in turn (Wolf 2007; Wynn and Coolidge 2012, ch. 3; Borzacchini 2021). Can we direct this kind of change in some ways that will be better than others?

I would argue that the dream of technological transcendence, a kind of Gnostic theology for disembodied beings emerging from embodied creatures, is not the right model (Shiffman 2015). Ironically, it reflects our species' tendency to think about minds and spirits as distinct from our bodies, which just mystifies the kinds of social constraints that may be limiting us (Flannery and Marcus 2012; Lynch 2019). By contrast, lineage thinking allows us to think about how past constraints at many points in evolutionary history not only set limits on what we can do and think, but also shape the possibility for certain kinds of changes to those limits. It does not do so in ways that simply eliminate those constraints, however.

A good example is the role of biological and cultural neoteny in making science possible (Gould 1977; Elia 2013). Homo sapiens may have outcompeted other hominins by an extended adolescence, or neoteny, allowing greater transmission of cultural knowledge. Neoteny can emerge in situations of rapid environmental change as a mechanism to allow rapid adaptation in ways that the ordinary rate of mutation-driven change cannot do. Suppressed genetic variation in traits can be brought to the surface for selection because juvenile development typically displays a wider range of traits than adult behavior, a key process behind the domestication of animals (Francis 2015, 16).

Our own evolution of behavioral modernity in the Upper Paleolithic may reflect a kind of self-domestication, allowing a longer period of cultural learning that was exploited as we developed more knowledge that could be transmitted accurately to future generations (Greenspan and Shanker 2004; Dugatkin and Trut 2017). Only with this extended time for play, as it were, could we develop new kinds of knowledge that made possible higher rates of innovation than previous tool-using primates in our lineage. Arguably, this biological neoteny is furthered through cultural neoteny, facilitated by the demographic revolution's extension of lifespan, and economic growth making possible extended schooling and "flexible specialization." This has allowed deferral for some of a transition to the burdens of employment for economic necessity that had characterized life for the vast majority (Charlton 2006; Crawford 2009; Brennan and Waits 1995).

What's remarkable about modern science and technology is the way that we have managed to take creatures with certain kinds of inborn errors that systematically mislead us on all kinds of scientific topics, including local motion, population thinking, intentionality, agency, and complex systems, and find ways to rework our inborn hypersocial division of labor, to make progress on understanding these phenomena. To say that we can discover knowledge that goes against our default biases is not to say that we do so in ways that are unconstrained by the kind of creatures we are. In this respect, exobiology should be supplemented by an exosocial epistemology. How would different kinds of creatures, biological or otherwise, construct knowledge and how might it be different from what we do? Is nature written in

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differential equations or is that yet another hammer that blinds us into thinking that everything is a nail?

On this issue, compare Penrose (2004, ch. 1; 1999), who accepts the Platonic view of reality written in the language of mathematics, but rejects an algorithmic account of consciousness underlying contemporary AI orthodoxy, with Wolfram (n.d.), who essentially escalates computationalism from a theory of consciousness into a highly formal theory of everything. Awarded the 2020 Nobel Prize in Physics for his work on black holes and general relativity, Penrose's views on consciousness are speculative and depend upon a postulated, future theory of quantum gravity. Wolfram opts out of engagement with the scientific community entirely by self-financing and self-publishing his results, a new, problematic funding model for science we might call the *Buckaroo Banzai* regime (Mandelbaum 2020; Becker 2020).

His end-run around review by any core set of cosmologists and appeal to social media for support make it a post-truth science in Fuller's (2020) terms. Wolfram even sounds like Trump when describing the unprecedented significance of his findings. Wolfram may be trying to do for science what Elon Musk and Jeff Bezos are doing in wresting space exploration away from representative democracy. One underexplored aspect of transhumanism is its reliance upon the deep pockets and idiosyncratic projects of highly exploitative tycoons. There have been enough science fiction stories to warn us of the dangers here as well.

Once we have considered these issues, we can think about what it would mean to maximize our potential as a species and whether that is a desirable goal. My first exposure to this issue came in a distinctively neotenic social milieu, science club in high school. Immersed in the very same science fiction infused imaginary that transhumanism trades in, I argued that humans had better get their act together by maximizing human labor directed towards science. Aware that other professions were necessary, I conceded that maybe 1% of humans could be farmers and other professions necessary to sustain ourselves from a material point of view. With more scientists, more progress would follow, and space exploration and our destiny among the stars would be possible. The trick was to get everyone on board with this program (apparently I was following the argument laid down by Condorcet—see Fuller 2019, 189).

The logistical challenges of such a program would be extraordinary, as it would involve decomposing problems and directing labor in conscious ways that extended the lucky accident of what Collins (1998, ch. 10) calls rapid-discovery science that emerged with modern science. The small number of recognized core set experts in a given field repurpose our evolved ability to work in small groups, while communicating with other groups. So in this sense modern science in no way escapes the inherent limitations of our evolved capacity for social cooperation (Dunbar 2010). While I still believe genuinely democratic planning could direct resources in ways that improved our capacity to meet the challenges we face (Lynch 2020), the adult me fully admits the limitations of this proposal.

More to the point, however, there remains the issue of democratically decided goals in the first place, and the recognition of individual autonomy. My friend, Ben, argued that this goal of maximizing science was misguided because, in the context of comparison with potential extraterrestrial civilizations, our science would be neither unique nor terribly advanced. Instead, it may be our artistic creations that have the most lasting significance, which should not follow the demands of the collective in any event (Prine 2018; Simpson 2019b). Now, one might expect that the price of admission to a hypothetical galactic civilization would be first mastering the very basics of natural science, no matter how elementary, just as we require our neotenized progeny to first learn to play nice together or color between the lines (Fulghum 1988; Bowie 1972).

Moreover, as our science teacher, Mrs. Henley, pointed out, advanced extraterrestrials may look upon our artistic endeavors as just as primitive as our science. In this sense, *Star Trek's* constant reference to our own human cultural history as something that other species would admire, along with their own, probably reflects the equivalent of posting a child's drawings on the refrigerator. Nonetheless, Ben had a point. The issue of what our species has to offer the universe, if we may be so bold as to even ask the question, is at the very least an open question. I won't choose between science and art, as both may be equal combinations of natural constraint and free creation (Feyerabend 1994; see Fuller 2019, ch. 1, for a comparison of the role of Russian Cosmist scientists and Italian futurist artists in early transhumanism). But I don't think we can adopt a species-wide program for maximizing value, to add to the one from which we are already suffering.

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Now, could I be wrong about the implausibility of carrying out a transhumanist program? Am I not potentially adding myself to the list of those who made very bad predictions about technology, especially predictions about what cannot happen (Pestov 2017). Perhaps, although the failed predictions of bold new technologies that never happened is also a long list, and reflects its own peculiar hype and neglect of physical infrastructure and maintenance (Russel and Vinsel 2020). After all, we still do not have flying cars, no doubt for good reasons (Earle 2013).

A fallibilist approach to science and technology still requires that we make our best projections based on flawed knowledge. Popper tried to counter the purely negative character of his falsificationist approach with a (problematic) account of verisimilitude or approximate knowledge that brought back with it a "whiff of inductivism" (Lakatos 1978, ch. 3). The metaphysical claims about the world that science generates are particularly subject to change, even oscillation (Holton 1978), despite ever more accurate models underlying them (Liston 2017). Let's just say that a program that requires inventions such as wormholes allowing interstellar travel (Penrose 2004, 834-35) or computers that can encode and preserve consciousness is as much of a leap of faith as belief in God (Dylan 1996; Ranken and Fearnley 1988). Let those who believe do the work. The rest of us gave at the office, the plant, or the Amazon warehouse (Simpson 2016).

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