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Entropy, Said the Devil (Entropy & its Discontents: From Heat Death to the Eternal Return)

Dorion Sagan

One day though it might as well be someday
You and I will rise up all the way
All because of what you are
The prettiest star.
David Bowie, *The Prettiest Star* (1973)

The Devil:

Entropy is a mark of energy use, I impressed upon my friend, Simon Magus, inside his head in his own language. It is a cold fire. Destruction, I added on a more daimonic note, my breath hot on his labyrinth—life's cool fires. Of course, I exaggerated to him; I called life a cold fire, which for me it is: everything is relative.

Entropy—the heptagrammaton confuses, which is all to the God and the good, as it exemplifies the process it promises to describe. It is like that party game "Telephone," where one whispers a word to one's neighbour in a circle that returns, but never the same. When Claude Shannon sought a name for a quantity of unspecified information, for use in his new information or communications theory, my dear friend, John Von Neumann, whom I've also talked to, told him to use the seven-letter word, "as no one knows what it means anyway." Just so. Von Neumann himself, one hastens to add, was a bit of Brownian atom, his taste for alcohol (plentiful in space) lending his name to a place—Von Neumann's Corner—after a series of semi-stochastic crashes brought him again and again to the same location in Princeton, New Jersey.

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You know, despite my bad reputation, I like to help people, and over the years I've had the ears of many famous men, and not a few uncommon women. I like to introduce my ideas into scientists' dreams. Take Kekulé, who benefited from the image I provided of an ouroboros over a hexagon of six carbon atoms attached to six hydrogen atoms. Ergo the discovery of benzene and thence all aromatic compounds. Ah, superpositions. And sulphur fan that I am, it amuses me no end that your human, all-too-human nose in its nasal appraisal detects jasmine and orange blossoms encountering a certain compound in traces, while at higher concentrations the same compound brings on the distinct smell of poop.

But I digress, like a dancing star crashing to the centre of the Earth, and thus the early human universe, making on its way a pre-Copernican reversal, a punk rock music of the spheres.

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First the good news. Not I, but all of you will all die; however, it is not your entropic fate. I'm not saying you're being punished; in fact, you're lucky in this regard. But it is easy to see—using that bastard child of mine I gifted to you at the beginning of the European Enlightenment, Science—that you could have been immortal.

But you're not. You're merely human, unable to shapeshift, serpentify, become sleeping angels or intellectual monsters here in the fiery pit of your sleeping planet, or here [the Devil switches his position] in one of its outer dens.

Sadly, and it is only a stroke of fate, at best, but you might have lived forever—contrary to the late neo-Darwinist William D. Hamilton. Hamilton, Richard Dawkins's "intellectual hero," and "the nearest equivalent [to Charles Darwin] that the late twentieth century had to offer,"[1] "proved" that aging must exist. An artful pile of equations and syllogisms, Hamilton's monograph asserts that, "senescence is an inevitable outcome of evolution," which "cannot be avoided by any conceivable organism."[2] Fine in theory, but the devil's in the details. While thermodynamic entropy, a measure of the spread of energy, which dissipates on its own but does so more avidly in certain chemical and physical systems, including those of life, might be your fate, it proceeds at different rates. The cool, colloidal fires of life not only produce more entropy than would be the case without them but do so more long-lastingly via genetically supported metabolisms, and, of course, reproduction, which provides a constant supply of cold fires

1 Richard Dawkins, "Foreword," in *Narrow Roads of Gene Land Volume 2: Evolution of Sex,* ed. William D. Hamilton (Oxford: Oxford University Press), xv, xi.
2 William D. Hamilton, "The Moulding of Senescence by Natural Selection," *Journal of Theoretical Biology* 12, no. 1 (1966): 12–45.

with a tendency for exponential reproduction. It is this very tendency toward excess, this greed and lust, if you will, for concentrated energy sources of available energy (and matter) to rape and pillage in conformity with the behaviour described by the 2nd law—going from concentrated to spread out—which causes life forms some of their greatest problems; problems, I'm afraid, prematurely attributed to me.

Of course, I was there for the biblical plagues (and many others), even as I am here before you now. Remember 1874, that neo-biblical United States scourge—the sudden appearance of monstrous dark clouds, collectively half a million square kilometres in area, bigger than the surface of California? I do. Blotting out the sun, the dark clouds descended bringing the wildest weather, a dry hailstorm of huge brown grasshoppers, their thin wings upon disgusted humans hissing and glistening as they pelted down and about from the clouds upon depleted dirt and houses, their claws clinging to the clothes and skin, including me, dressed as a gentleman, unafraid as I stared into the dying bulges of their eyes. Before you get sick at such a spectacle, or try to blame it on the Devil, please consider your own pest-like behaviour of late, destroying the soils and razing three quarters of Earth's forests—which must, objectively, be considered the highest form of life this planet, and the most angelic—which I'll get to, if we have time, in the last two centuries alone. Before you cry the "Devil did it," or try to play God by "fixing" some of the problems you've created to sate your greed, which is, if I may say, a bottomless pit, take a good hard look in the mirror. There is no edifice for entropy production on this planet smoother or more effective than the arboreal one, rainforests sensuously sweating communicative volatiles and the precious beads of their vegetal sweat, warming them locally but forming energy-reflecting clouds on high, before giving fall to cooling rain.

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But I digress, we were talking about how living forms, the *effort* of living forms to maintain themselves, is naturally entropy-producing. No wonder they want to live—to dance—to do the bidding of an energetic universe.

Aging exists, but not in the universal way Hamilton "proved." The last reported sighting of a Rocky Mountain locust was in 1902. They depleted their amber waves of grain.

If you destroy what you have tried to conquer, you have conquered nothing. Not even, as nothing is better than nothing, and you haven't conquered that. And in any case, why conquer like a brute when you can seduce with logic and love?

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Consider animals. The production of entropy by the cold fires of life, metabolically "burning" merrily away, the evolution of multiple forms of cell metabolism, prokaryotes and archaea permanently merging to make cells with nuclei, starved cells with nuclei devouring one another when starved of nitrogen or other elements needed to keep them going and burning, has taken many twists and turns in its four-billion-year history here on and in Earth, and I have watched closely. The animals themselves, even the ones in your own chordate clade, are instructive in showing the variety of modes of energy use, some of which lead, instructively, to the precipitous, ultimately self-induced slaughter, of those who grow too big, too fast, too monolithically for their ecological britches.

Animal life *within* Earth's variety of sexually reproduced, symbiogenetic organisms includes many entropy-producing forms, all of which may contain a tinge of what we may call "pride," a desire, however pitiful, for their own continuance. The irony of the greedy history of animal life, in some corners of its kingdom, is the recurring necessity for forms that tend to grow so fast they destroy their environment—their food sources, for example, as in the case of "grasshoppers"—now, suddenly, en masse, swarming under the influence of serotonin, not so hoppy as locusts ready to descend for their last supper.

The last reported sighting of a Rocky Mountain locust was in 1902. They depleted their amber waves of grain. One hesitates to speak oracularly to such a literal-minded audience, but there it is.

Life's cool fires always tend to spread, but when they destroy the last of their matter and energy, for whatever reason, they too perish. That is natural selection, of which I am a great advocate.

While all metabolizing organisms measurably produce entropy, their own spread even and especially as entropy-producers imperils them, sometime to their mass death. We can play the blame game. Starvation, Infection, Pollution unto local or global thermodynamic Dysfunction perishing in one's own or others' wastes, the most subtle of which is heat, which is neither liquid, solid nor gas, but which can, nonetheless, mitigate or destroy not just individual species like yours but entire ecosystems. The Four Horseman of the Apocalypse, Pestilence, Famine, War and the final, pale horse, upon whom rides Death, accompanied by Hades.

The last reported sighting of a Rocky Mountain locust was in 1902. They depleted their amber waves of grain.

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But, alas, Death, along with Hades, and Yours Truly, have received a bad name. Fast-replicating viruses, which are not alive because they don't metabolize but, like memes and machines, can become integrated into life's cool fires, which tend to integrate more and more elements in the Periodic Table over the course of evolutionary time, spore-forming and other bacteria, insects (sometimes carrying deadly prokaryotes), rodents, are among the many beings that tend to grow too fast as they pursue—as is their fiery wont—maximal entropy production.

However, neither I, nor natural selection (one hesitates to speak of Capitalism) tolerates this.

Nor do the cool fires of life of which I, alas, am only a small part.

Some age fast. Animals just in humankind's own chordate phylum, one of over fifty animal phyla, that age fast are octopuses, Progeria victims, Dolly the clonal sheep (dead at 6 of lung disease, which typically affects older sheep), Coho salmon that breed only once. Outside your phylum we find the mayflies including *Dolania americana*, adult females of which live only five minutes. Less time than it takes to smoke a cigarette.

Humans, elephants, Atlantic salmon that swim upstream a second time, and naked mole rats age more slowly. Albatrosses show no signs of aging but then drop dead in their early forties. And some organisms, defying the idea that the spread of energy of which entropy is a measure has anything directly to do with aging, include non-agers like Blanding's turtles and lobsters, the latter of which show no decline in fertility as they age. Many-headed hydras rip themselves open to eat and regenerate when they are cut in two.

So too sharks, many protists and bacteria fail the statistical sense of senescence: they are no more likely to die next year than they are this year. While *Sanicula*, a Swedish shrub, lives about 70 years on average, a 70-year-old plant is no more likely to die than a ten-year-old one. The fact that *Sanicula* does not age is a fly in the ointment of Hamilton's argument that all organisms must age.

Some just say no to mortality, although they may still be killed. I belong to the first category; time will tell about the second.

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Octopuses are good examples of the opposite. With light sensors on their tentacles and skin, female octopuses care for their eggs, but if conditions are not right, they dine on their own caviar, fortifying their chances for later. If things look hunky-dory, the octo-mom's mouth seals over and she lives for years in a concentrated state of guarding her eggs; once the young hatch, however, she—dispensable in the same and murderous logic of natural selection for which I confess a distinct respect—dies within days. But not from starvation. Rather two endocrine glands, so called optic glands but unrelated to the eyes, execute her by inner firing squad. The glands secrete substances that control mating behaviour, maternal care, and death. If both optic glands are surgically removed, the mother octopus lives on; if just one optic gland is disabled, she doesn't eat, but still lives an extra six weeks. With both removed, her mouth doesn't disappear, and she resumes eating after her eggs hatch, increasing in strength and size, and sometimes living almost a year longer.[3]

Quite clearly the death of such animals does not come gradually by entropy, but suddenly by natural selection, which has introduced switchblades into the genome and phenome—not to safeguard individuals but to kill them off, the better to continue the larger bio-pyres of which they are part.

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In my view, the fashion for thinking that aging is universal and traceable to the wear and tear of entropy, simply universalizes humankind's own and highly limited experience as gradual agers; I put it with the 19th century formulation of thermodynamics that led Lord Kelvin unseasonably to prophesy the eventual heat death of the universe, whose antiquity and futurity, while unknown, is presumably infinite. But even the Devil is not qualified to speak of what may happen to the Great Fire of which we cool embers, whose sparks may contain a touch of the infinite, are only small parts.

Beyond fast agers and no agers we have "whoa" agers like F. Scott Fitzgerald's character "Benjamin Button," who grows younger, perhaps finishing outside the story in his parents' simultaneous orgasm, the better to be born again. Nonfiction examples of the process include carrion beetles and the hydrozoan, *Turritopsis nutricula*—"the Immortal Jellyfish." Under stress the beetles revert to larvae, while the medusoids return to a polyp stage. Indeed, even non-living fluid dynamic systems, such as Taylor vortices, return to the past under reduced energy regimes. The laboratory-produced vortices, which appear in pairs and grow in number, appear not as organisms do, between chemical energy (chemolithotrophs) or light gradients (photosynthetic bacteria), but in liquids submitted to rotational

3 Jerome Wodinsky, "Hormonal Inhibition of Feeding and Death in Octopus: Control by Optic Gland Secretion," *Science* 198, (December 1977): 948–95.

pressure gradients between counter-rotating cylinders. When the cylinders rotate more slowly, the loss in their rotational pressure gradient leads them to retreat to earlier levels of organization, for them fewer pairs of counter-rotating vortices. Perhaps an analogy could be made to the Anthropocene or, if that hits too close to home, the city of Florence under Savanarola, suffering from economic hardship, and becoming more autocratic. When acellular slime moulds run out of food, they form a mass structure, a proto-body, a translucent, dancing plasmodium; most of the cells die, but not before releasing new swimming cells. Here we see, in the body itself, a kind of return to earlier stages of organization; here we are looking, as it might be said, directly at evolutionary trauma. One that does not destroy, but preserves, the entropy-producing organism.

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So, no, aging is not an entropic necessity, but naturally selected. I was not here for the origin of life on Earth, but let us assume, as your current science tends to imagine, that it evolved in the Hadean or Archean Eon, in a hydrogen-rich atmosphere more characteristic of the early solar system some four billion years ago, before that lightest of gases in the Periodic Table escaped into space, where it is preserved to this day in the hydrogen-rich gases of the trans-asteroid belt planets. Even if its forms were extremely hardy from the beginning—of extremophiles, such as highly heat-, nuclear radiation-, and desiccation-resistant forms that still exist, materially cycling, growing, reproducing beings always run the risk of destroying themselves by reproducing too fast, and thus depriving themselves of the material or energetic resources they needed to survive.

Unlike humans, early, multifarious microbial life, some of whose forms still survive today, had multiple means of metabolism, only one of which (aerobic respiration—reacting food eaten with oxygen breathed) directly supports human life. Earth's living systems are *open* thermodynamic systems. Although not their moral or aesthetic purpose, their cycling of matter in the service of the dissipation of energy gradients is their physical *raison d'être*, no less than the candle's flame is to burn. There is no entropy production without openings, orifices, no matter how small. It is impossible to imagine a live being that is not an actively entropy-producing one. The idea that life violates the second law of thermodynamics, understood as the tendency for energy to move from being concentrated to dispersed, is, therefore, pablum. And thus, there is no reason to name personalities as distinct as the gobsmacked Pope Pius XII, (who invoked the second law as proof of God's existence, apparently because only He can violate the law of ever-increasing disorder to produce organized life), or the neo-Darwinist analytic philosopher Daniel Dennett, who contended that organisms "are things that defy" or constitute a "systematic reversal" of the second law.

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In thermodynamics a "closed system" (in typically strained scientific language) means closed to matter but open to energy exchange. An isolated system—however, impossible such a thing may be— describes a system protected from flux, inflow or outflow, any kind of exchange with the outside world, even, theoretically, gravity. A perfectly closed system thus keeps all its matter but can accept and donate energy. Metabolising cells and bodies, e.g., your inhaling, eating, excreting, drinking, pissing, farting, sweating, bleeding selves, are open systems.

Ergo your ability not only to take in hors d'oeuvres, the cute Devil's food cake cookies and other assorted goodies I've laid out— please, fear not my fiery eyes, do not hesitate to come and take a bite as I speak— but the sights, sounds and information, if any, imparted by these words. Yes, yes—go ahead and eat, I long to divagate, distract, and delay.

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One almost longs for the early days of this planet, red like my pupils when seen from space, those delicious days of constantly crashing tectonic plates, gurgling volcanoes, so full of hope and violence, with dust-and-smoke-strewn crimson skies, comparable to the smog over Los Angeles which, as your poet Bukowski suggests, is like love, billowing forth before the morning sun burns it off. But I digress, like a selfish meme replicating itself on the internet, like your cell phones and computers, indeed like your whole project of artificial intelligence which, indeed, is justly named.[4] A car may be part of you, you may flinch when the fender bends; you may feel lonely on or off social media, connected or disconnected by the phone. But the unheimlich house, the oikos, has always gone from the ungainly outside to become part of the realm of integration and recycling of wastes, one of life's ancient games. Did not the calcium ions whose over-concentration in ancient marine eukaryotic cells lead to calcium carbonate skeletons and skulls, to marine creatures of surpassing function and beauty, their stockpiled calcium with carbon atoms forming ornate shells, living Venetian blinds adjusting the rates of photosynthesis for maximum energy expenditure, comfort, and survival? Is not my own becoming smile evidence of the surpassing beauty and cunning of microbial teams, stockpiling deadly calcium ions in flashing molars and cutting canines? Forgive my chuckle. It has always been; thus, organisms perceive, they aggregate, they act, they interact, with themselves and their surroundings; and over evolutionary time, as they grow and

4 Bernard Stiegler, "Artificial stupidity and artificial intelligence in the anthropocene," *Academia.edu. https://www.academia.edu/37849763/Bernard_Stiegler_Artificial_Stupidity_and_Artificial_Intelligence_in_the_Anthropocene_2018_* (2018).

expand and excrete into the environment, proprioception extends; wastes can become integrated, the house becomes the body.[5] You are in a sense a multi-story moving building made by intelligent bacteria.

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Like me, and six-sided Bénard convection cells, first found on the underside of photographic plates or, more to the point, like you and your huge brown grasshoppers becoming airborne locust swarms under the influence of serotonin, destroying their food supply and thus wiping themselves out and giving you the Dust Bowl for your troubles, I know a thing or two about nonequilibrium thermodynamic systems that grow too big for their britches.

"What's better than a robot coming out of your head and going to Mars?" asks indigenous philosopher Ailton Krenak. He is annoyed at the sight of a Chinese billionaire wanting to start a health club on the moon. Will it be the first in a chain?

Applying black paint dramatically to his face in the 1980s, Krenak convinces the Brazilian congress to stop their appropriation of the Amazonian rainforest. His last name refers to his tribe. Forcibly separated from his kin, the Krenak, of which today fewer than 200 individuals remain, I was there not only when Jesus had his moment of doubt and pain, but some time ago, in the Amazon, when Krenak encountered another indigenous leader. The other indigenous leader was worried:

> "These white people," he said. "How many are there? Are there more than ten?"
> "Yes," replied Krenak.
> "What do they eat?"
> "Everything. Forests, rock, everything."
> The other indigenous leader's eyes grew wide. "Where do they shit?"
> "Everywhere."

In fact, pollution is a leading cause of human mortality. Particulates from cars, planes, and industry, although they cool incrementally during the daytime by blocking light, more than make up for that sunshield by reradiating solar and terrestrial radiation at night. Moreover, when the upper atmosphere becomes too warm, convection slows to a grind or stops, preventing some of Gaia's swirling currents from dissipating energy into the atmosphere. If only CO_2 were the main cause of global warming, insofar

5 Lynn Margulis, Luis Rico, and Dorion Sagan, "Propiocepción: Cuando el Entorno se Hace Cuerpo," https://root.ps/download/tecnomagxs/Corr_Margulis_Propiocepcion_cap_1.pdf.

as it exists. But the residence time of carbon atoms in the atmosphere is far longer than particulate pollution, which both accumulates and precipitates out on a much shorter time scale, of days and weeks rather than decades and centuries. This may be good news for those willing to fight against global warming. And as Spinoza pointed out, it is good to know things for their own sake, even if you can't do anything about it. It doesn't help that you latter day great apes—I see a hairy hand there—yes, you!—have razed seventy percent of this oceanic orb's forests in the last two centuries.[6] You are cutting down the trees through whose stomata, holes in the leaves through which comes the water vapor to form light-reflecting clouds and the terpenes and other compounds that form cloud condensation nuclei, make the rain of the rainforests. While Mars and Venus sport burnt out atmospheres of over 95 percent carbon dioxide, Earth's atmosphere remains under ½ percent; and yet every day the chances of Nuclear Hell—not just bombs but the ensuing darkness and heat from reradiating particulates—increases. Such an increase of local entropy would represent an unfortunate increase in an already suggested global thermodynamic dysfunction, a further blow to healthy, unblocked rates of geophysiological entropic release. It is always a mistake to overhunt one's home, as Artemis impressed upon Orion before contract killing the hunter, not for making love to her without saying he was married, but for killing too many of her deer. For such eco-excess the Greeks give us the night sky: if you can even see the stars, let alone the milky galactic centre of the galaxy—the constellations Scorpio, Orion's giant arachnid killer, sent by Gaea to remind humans ever after. (Perhaps she did not predict the future's light pollution.)

While people babble about carbon credits and space travel, vaguely imagining they might escape the mess they've made on the surface of this gravitational well, sleek, silica-extracting diatoms, jewel-like diatoms, whose bodies are like the exploded remnants of multi-coloured stained glass living cathedrals floating in the sea, contribute an estimated 40% of the breathable oxygen per annum to Earth's atmosphere. Oxygen, O_2, which provides you humans with your fresh air, the reactive gas—once a deadly, poisonous gas to Earth's anaerobes—so necessary for your industrial Technosphere, from its automotive urban sprawl to its digital communications and militaristic technics. The waste product of oxygenic photosynthesis, now an invisible medium for energy extraction.

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The last supper for a bacterial colony spreading across a Petri plate is the one indulged in by its largest reproducing population, the one immediately prior to collective collapse.

6 John Feldman, "Regenerating Life: How to Cool the Planet, Feed the World, and Live Happily Ever After," 2023, hummingbirdfilms.com/regeneratinglife/.

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Humanunkind threatens long-term entropy-production by destroying long-evolved ecosystems. Masses of living beings, of the same and of different types, with their little purposes and no central planning, have evolved unconsciously intelligent ways of moderating their growth as they live together, the better to survive in the long run. In the wake of too-fast growth one finds degradation, collapse, mass death by starvation, infection, pollution. Wilde may have said nothing succeeds like excess but the Pythian principle once engraved in stone at the temple in Delphi, *meden agan*—"Nothing in excess"—prevails. Everything in moderation, my friends, yes? Including moderation. [And here the Devil gave a throaty laugh.]

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We share a common purpose, my friends: to burn. To keep on burning, to be *on fire*, to *live*. Awareness allows one to be part of an ecosystem, to anticipate, even and especially unconsciously, what is needed to avoid disappearing into the unpublished annals of evolutionary ordinariness. Although the road to immortality is a long run, it thus may interest you, my mortal friends, that nematodes age faster not only if they eat their fill but even if they merely *smell* yeast paste, their food.[7] For life chemicals are not just materials, but signs, as demonstrated by that weird datum that indole, the smell of orange blossoms and jasmine tea, also, in higher concentrations, registers as faeces.

The poison, as my old friend Paracelsus put it, is the dose.

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Believe you me, no one is as big a fan of death and destruction, the licking flames of erotic fires, that sort of energy which Blake reminds us of is "eternal delight." Just so, but forever is a long time. The grace of nature is to keep the torture-pleasure going; it will not surprise you that local diablogenesis has nothing to do with eschatology, soteriology, or ethics, but rather with the history of human culture, its linguistic formulations, and, in retrospect, local planetary biophysics. Speaking as a mixed, imaginary (in the Lacanian sense) being, I want to try to tell you that the djinn or stars don't have sensation and intellection but you, also mixed beings, do. Do you think that my friend, Herakleitos, who compared the universe to a vast fire, when he posited over two thousand years ago, that each human has his own private dreamworld, the *idios kosmos* to which one returns each night during the forty percent of one's

7 Scott D. Pletcher, "The Modulation of Lifespan by Perceptual Systems," *Annals of the New York Academy of Sciences* 1170, no. 1, (August 2009): 693–697.

life that one sleeps, and that while awake you share a *koinos kosmos*, the shared world of culture; do you think, for a minute, that by shared world, by *koinos kosmos*, the great Herakleitos, who justly compared the cosmos to an eternal fire, was thinking just of humans?

No, of course not, he was a mixed being, a philosopher, who is never just a human. George Bataille[8] writes of writing as bleeding, the slow sacrifice, and imagines the evolutionary history proceeding from knuckle walker to cosmic voyager, the epic journey interrupted only by the unforeseen migration of the pineal gland migrating to the top of the head, humanity thus reaching a kind of happy ending, with the sun, the object of life's desire, aimed at but missed as human bodies ejaculate through their new apertures atop the heads of men, of "Man." The travesty and parody marks an ironic end to a once more promising creature.

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In this sense [said the Devil, and here the roar of his laughter was magically accompanied in the dark-lit grotto by orange, green and blue flames from his mouth, while foul-smelling sulphurous fumes curled up from his nostrils] one must redress your notions of entropy and its relationship to life, equally misguided at times from both the theological and the scientific side—and, of course, the political, but I digress, like static on an intergalactic message.

In your species' current science, especially concerning the thermodynamic quantity usefully but

8 Although Bataille is best known in literary and postmodernist studies, behind his thought is the deep thermodynamic reality of solar excess; one might say that, if for Freud and Lacan the phallus is the master metaphor, for Bataille it is the Sun and solar excess. (I would argue that Bataille's analysis of the ways this solar excess feeds into rhetoric beyond discrete signifcation is evident in Jacques Derrida, "La mythologie blanche: la métaphore dans le texte philosophique," in *Marges de la philosophie* [Engl. *Margins of Philosophy*] (Paris: Les éditions de Minuit, 1972): 247–324. See especially the paragraph about "L'ellipse du soleil: l'énigme, l'incompréhensible, l'imprenable.") In his thoughts on the Sun, Bataille was crucially influenced by his 1929 reading in French translation of Vladimir I. Vernadsky's *La Biosphère* (Paris: Félix Algan, 1929), which he references in *The Accursed Share* in a chapter about the "Exuberance of the biochemical energy and the growth." Via Derrida primarily, these thoughts have entered continental philosophy. I would argue that the Sun, the main energy source for surface life forms on Earth, becomes, via Derrida, a post-Lacanian master signifier that does away with the zoomorphism of the phallus, the master signifier of psychoanalysis. The end state of isolated thermodynamic systems may be stasis (*thanatos*), but the open complex systems of living beings actively delocalize concentrated energy (a process accompanied by a generalized eros?) to continue their existence as metastable, nonequilibrium thermodynamic systems whose goal is not so much death as entropy production, made possible by cosmic gradients. See e.g., Dorion Sagan, "Bataille's Sun and the Ethical Abyss," in *Cosmic apprentice: Dispatches from the Edges of Science* (University of Minnesota Press, 2013), 33–40.

confusingly known as entropy, I'm afraid most of you are quite lost. Entropy is both simpler and more complex than commonly thought. But entropy at heart is elegant in its simplicity, more elegant than I am dressed as a gentleman in evening clothes. It is not synonymous with disorder. As my long lived but now permanently dead friend Frank L. Lambert (1918–2018) pointed out, virtually any collection of particles above the temperature of absolute zero is almost infinitely disordered. At heart entropy—and Lambert was successful in persuading authors of all the main US chemistry textbooks, and some of the physics textbooks to include this in their revised editions—is a measure not of disorder but dispersal. (The notion that it is "disorder" derives from Ludwig Boltzmann's common-language summary of hundreds of pages of mathematics in his *Lectures in Gas Theory*).

Although Lambert did not specifically attend to the thermodynamics of life, let alone of more-than-living things such as my selves, his refurbished summary of the essence of the behaviour described by the second law holds for both equilibrium and nonequilibrium systems.[9] There is no worry (and here one must agree with Nietzsche) that the world will slowly grind to a halt, like a carnival with all its rides stopped, the people gone, the sun gone down and the performers now out of town; no worry such as that portrayed in Pynchon's short story, Entropy, where a baby bird, like America or the blue Earth, may be ending one fine and final tepid day. Rather, as Nietzsche reasoned, if time could have an end, it would have ended already.

But no, things continue, fast and furious, slow and dreary, hot and cold, gravitational and thermodynamic, forever; new stars are born, grow, go supernova, old ones die, their atoms recycled into new systems, the carbon atoms of your body synthesized by the triple-alpha process from He, helium, in the depths of stars. There is no end to the fun, or futility.

Far from violating the second law of thermodynamics, living matter such as yourselves can hardly be understood without realizing that you operationalize a core process of the universe, the tendency, one might even say the compulsion, for energy to spread—which is, quite paradigmatically, *demon*strated by the living beings you all are.

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9 For entropy in equilibrium thermodynamics see Harvey S. Leff, "Thermodynamic Entropy: The Spreading and Sharing of Energy," *American Journal of Physics* 64, no. 10 (1996): 1261–71; and Harvey S. Leff, *Energy and Entropy: A Dynamic Duo* (Boca Raton, CRC Press, 2020); for entropy in nonequilibrium thermodynamics see Eric D. Schneider and Dorion Sagan, *Into the Cool: Energy Flow, Thermodynamics, and Life* (Chicago: University of Chicago Press, 2005).

And here one is amused at the lack of rectitude at both ends of the religio-secular spectrum in maintaining otherwise. Complex materially cycling systems, from swirling storms reducing temperature and bariometric pressure gradients to more long-"lived" fluid dynamic systems such as "Whirlpool" downstream of Niagra Falls and the Great Red Spot of Jupiter, a storm in frozen hydrogen-rich gases at least hundreds of years old whose area encompasses three Earths, to biochemicals-recycling, gas-, solid-, liquid-, and heat-excreting systems of more familiar animal and industrial systems—all of these active cyclers spread more energy than more motley forms of matter. They embody it, their inner organization crucial to the accelerated local production of entropy. You are no different.

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Now I [spake the Devil, producing between gnarly hands great streams of multi-coloured bank notes of a variety of currencies] am no doubt just an alchemical apparition, a literary phantom with no claim to truth claims or, indeed, anything other than disposable entertainment value, whatsoever. But as you see, these hundred-dollar bills and Euro notes survive burning. Now look at them again and you can see that they've lost their face value, so that they have now become mere blank white strips of paper, worthless because they have no symbols on them. The symbolic is humanity's greatest opportunity, and greatest curse.

Now, look!

[At this point the devil produced an ordinary, blue-back pack of Bicycle playing cards, which he said were fire-proof, and fluttered them from hand to hand, making a series of fiery cardboard waterfalls, fans, florettes, springs, and shuffles, that he claimed demonstrated both the transition of discrete objects into waveforms ("the classical into the quantum"), and solids into fluids ("isolated parts are integrated into the waves"). After this he did a trick with three red and three black cards, alternating them one by one in what he called an "ideal mixture" and a "perfect shuffle." Pattering about God separating the heavens and the Earth in the beginning, he then showed that the cards had "rectified the gradient" without "any work being done." He repeated the trick slowly, alternating the cards and having them separate, with no suspicious movements, three times—the number of times Houdini claimed he needed to see any trick before he could figure it out. At the end he pointed to the designs on the back of the cards; turning the packet of symmetrical pasteboards, he told his audience: "You see, they're not angels, they're demons—Maxwell's demons."]

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Let's review. Matter and mind are connected, deeply, although thermodynamic and informational entropy are not the same thing. Information theory as it is known today began with a book written by Claude Shannon and Warren Weaver in 1949 called *On The Mathematical Theory of Communication* in which they introduced another concept of "entropy." When they didn't know what to call their new mathematical measure of messages, their mathematician friend John von Neumann told Shannon, "call it entropy, no one knows what entropy really is, so in a debate you will always have the advantage." Shannon took von Neumann's mischievous advice. This added to the confusion. In information theory entropy describes the uncertainties associated with the utilization of characters in sending and receiving messages. This is a different use than found in thermodynamics. In a thermodynamic system the basis for assigning an entropy value comes from the uniqueness of a system's matter-energy distribution at a molecular or atomic level. At any one time a system can have just one particular microstate out of many possible. Although there is a similarity in theory here, it is seductive in that it is greater in the equations than in that to which they refer. In fact, much the same equation was applied even earlier to games of chance by French mathematician Abraham de Moivre (1667–1754), a Huguenot pioneer of probability theory who served as consultant for insurance companies and gamblers. As early as 1968 American cancer researcher and photobiologist Harold F. Blum pointed out that, despite the superficial similarities between informational and thermodynamic entropies, seemingly separated only by a minus sign, there was the potential for hybrid equations to be developed that could apply to natural selection. Blum devised a negentropy-like equation that measured what he called the "expectabilty of evolutionary change without being concerned with its probability in the larger system in which it takes place."[10] Today, entropy proliferates in dynamical systems theory: there is metric entropy, topological entropy, algorithmic entropy, entropy as the fractal dimension of an appropriate compact set, even *galois entropy*, which is related to geometrical asymmetry; these various mathematical subspecies of informational entropy share a concern with unpredictability, incompressibility, asymmetry, or delayed recurrence. But none of this will be on the quiz, and Von Neumann's founding confusion holds, the Devil takes it. My friend Dorion Sagan, whose fingers I've used to dictate this essay, noticed that the techniques card counters use in casino blackjack invariably deploy a mathematical system that identifies a gradient—when the deck(s) is/are "hot"—that is, when the shuffled pack or packs, measured by keeping rough track of the cards that have come out, and thus those remaining undealt in the shoe, contain a preponderance of high cards and aces which, other things being equal, can give the good player an average hourly earnings of 1½%. In practice, this means for $100 bet the expected earnings would be $1.50—more than his average gains in the Bahamas, Atlantic City, the Mohegan Sun, and Las Vegas, especially after expenses. But I digress, like the RNA viruses which helped evolve the placenta.

10 Harold F. Blum, *Time's Arrow and Evolution* (Princeton University Press: Princeton, 1968), 207.

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I've been here a long time, on Earth as well as here to-day, so let me attempt to begin to bring the never-closing, always burning curtains to a close. The biosphere behaves as a behemoth, a beast if you like, its planetary surface (and its deep hot biosphere, where I hang) no more a rock with some life on it than you are a skeleton infested with cells: like the rainforests which are its crowning non-creation, the highest life form, its main waste product is not urine, faeces, or even gases such as carbon dioxide and oxygen, but rather heat into space. Spit, snot, sweat, semen, blood, tears, colloidal substances, phlegm, any number of intricate substances encased in waterproof but permeable keratin-based skin. As a thermodynamic final product, heat, although it can run steam and handheld Sterling engines, is not a concentrated enough energy source to serve any form of living metabolism. (Making the philosophy-dissing Neil deGrasse Tyson scientifically wrong when his voiced narration at the Hayden Planetarium asserted that roiling ecosystems of tube worms, blind shrimp and crabs at the bottom of the sea were fed by heat from Earth's interior.)

Now when Stiegler uses the term Entropocene—and negentropy,[11] neganthropy, neganthropology, and Neganthropocene and so on,[12] the terms multiplying like brooms in *The Sorcerer's Apprentice*—he has a point. Earth's surface is a mess, and it is partly humankind's doing. It is not the only species to do so. The apatite of our teeth, the calcium phosphate encasing of your skull, and your skeletal infrastructure, your walking bones began in the toxic calcium ions nucleated marine cells had to extrude not to be poisoned. Stiegler recognizes the pharmacological nature of writing, the Socratic supplement and Derridean pharmakon or vice versa as it applies to technics. It giveth, and it taketh away. The number in your phone you no longer remember, as it is outsourced to another, not living this time. Writing too is of the earth, a piece of bark, footprints in the mud, blood on the ground symbolically reproduced as plant pigment on a face or in a cave, a heel in the sand or carved stone. (The internet, for which I had such high hopes in influencing humanunkind for the better, the web as nothing but humans and technics but less than the sum of its parts, a less than human brain, has, frankly, proved disappointing). As with the waste products of calcium, from which such unholy temples as that of human and other inner and exoskeleton are made. Or diatom-produced silica exploded from volcanos providing their silicon atoms taken in by new diatom blooms, perhaps to be integrated into future iterations of Macs long after anything recognizably human remains.

11 Coined but later dropped by Schrodinger, who later admitted that what he meant was Gibbs free energy as the source for life's spatiotemporal organization.

12 Daniel Ross, "The End of the Metaphysics of Being and the Beginning of the Metacosmics of Entropy," *Phainomena,* no. 112/113 (June, 2020): 73–100.

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Bataille's evolutionary parody, man's headlessness as he ejaculates his contents, beginning with the pineal eye, migrated to the top of the head, then the brain, into his solar object of desire, illustrates the folly of a *momentary* maximum entropy production that robs a form of the partly stochastic and unconscious process of an *extended* entropy production which has, so far, in the case of "man," given Earth a mixed bag of everything from baseball trading cards to satellite communications and radio telescopes even as this same anthropic force has decimated forests, and produced, via technics, pollution, and biodiversity loss the equivalent of a global fever, similar to the temperature elevation and biodiversity loss of forest ecosystems exposed to nuclear runoff. Insofar as particulate pollution, including by car pollution and attempts at weather modification, destroy the convective currents that put the literal wind in the sails of the European age of exploration, the biosphere will swelter; while the second, cosmopolitan or aggressive age of human space exploration and colonization, will likely remain mythical. Space is not the ocean. The planets are not islands.[13]

The 21st century ennui with the humanoids of science fiction and false reports of little green men and their ilk is the rage of Caliban seeing his own face in the glass. The 21st century—and other centuries'—feeling of loneliness in an infinite cosmos is the rage of Caliban not seeing his own face in the glass. Life at Earth's surface as each of you very partially experience it is an open thermodynamic system in space, transforming the solar gradient between Sun and space, primarily through the advanced, sensitive natural nanotechnics of water-using photosynthesis, into the redox potential of Earth's highly energized, because continuously oxygen-supplied, biosphere.

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Well hell's bells! people—that you all are going to die individually doesn't mean that the species will expire soon, although it is due anyway, as the average age of a backboned species in Earth's fossil record is four million years. If and when *Homo sapiens* does go, it does not by any means mean the rest of the not as mean biosphere will follow: this is more restless anthropomorphic projection. The apocalyptic tone of philosophy[14] is joined by voices speaking in the name of science. But unlike some other planetary and cosmic concerns analysed by philosophers—e.g., the speculations of Kant, following Fontenelle, on intelligent life beyond Earth, whose existence could provide a context for the desideratum of world

13 See Carl Schmitt, *The Nomos of the Earth* (New York: Telos Press, 2003).

14 Peter D. Fenves (ed., trans.), Immanuel Kant, and Jacques Derrida, *Raising the Tone of Philosophy: Late Essays by Immanuel Kant, Transformative Critique by Jacques Derrida* (Baltimore and London: The John Hopkins University Press, 1993).

peace[15]—the analysis of Earth's planetary condition, is *not* unique: it is an example of thermodynamic dysfunction, which has been chronicled in forest ecosystems exposed to heat and radiation from nuclear runoff, and even non-living complex systems (e.g., Bénard cells, "multiplying" typhoons, and long-"lived" Belousov-Zhabotinski chemical reactions) that exhibit physiological malaise unto "death," when the gradients they are reducing—be they of temperature, pressure, or electron potential—and upon which their continuing organization depends, become too steep or insufficient.[16]

If technical humanunkind is a djinn, a swirling creature of smokeless fire occasionally granting wishes but best kept closed in its bottle, so the biosphere as a whole resembles an angel, a creature not of fire but of light. (And here I speak with some experience.) Like the beautiful ethereal virgins promised to martyrs in paradise, a Persian word, the houris who never micturate, menstruate, or defecate, the Gaian biosphere runs clean, gently using energy and moving it away from its sensitive, living surfaces. It is an angel, subtler than any organism, which cannot recycle its own material wastes. Naturalizing life as a cosmic form of entropy production links mind to matter even as it throws a wrench into humanity's supposed unique and superior intelligence, in part because the long-existing problem of extinction-level imperilment by overpopulation and ecological overuse, although elusive for you big-brained technological apes, appears already to have been solved by the (epi-)genetics of your own bodies, which ensure timely aging and death, thus providing a stopgap against ecological overkill. As shown by my card trick, "Maxwell's Demons" there is a link between physics and metaphysics, from heat death to the eternal return. The latter is clearly more real than the former. Nietzsche experienced being out of time at the rock at Sils Maria, then looked to science, especially the thermodynamics of eternal recursion given an enclosed space and infinite time, to provide a physical justification. He reasoned too, and correctly, that if time could stop it would have already. Of course, Victorian physics did not take gravity into account in their isolated adiabatic boxes. The real cosmos is infinite. It is not the return of the "same," as Heidegger schoolishly argued, but more like the "return of the return," as Deleuze argued. The return, already always, of an entropic cosmos, occasionally revealing itself, and then hiding again, forever and a day. My good friend Anaxagoras, the first philosopher to suggest panspermia, the idea of the cosmos as a wild garden of life forms, travelling from sphere to sphere, also developed the idea of perichoresis, that even an infinite mixture could be recovered back to its beginnings, if any, through nous, mind. The faro shuffle, known to card sharks, shows this: a normal pack of 52 cards, shuffled perfectly, done eight times, will bring the cards back to their exact original order. It is possible to disguise the faro as a corner riffle shuffle.

15 Peter Szendy, *Kant in the Land of Extraterrestrials: Cosmopolitical Philosofictions* (New York: Fordham University Press, 2013).

16 Schneider and Sagan, *Into the Cool*.

But alas there is no evidence that we are in a physically closed system. The cosmos may be infinite, in which case you are an infinitesimal part of the infinite, lost and found. I'm afraid that for the moment and perhaps the foreseeable future [here the Devil tapped his formidable forehead], you will be not only a planet-confined but a land-locked (not true for me thankfully) species, restricted to the continental land masses, but that does not mean you should not take some Spinozistic joy in knowing for the sake of knowing, looking at life *sub specie aeternitatis*, from the viewpoint of the eternal, or at least cosmic and evolutionary, within your little bubble. And here a simple experiment may help demonstrate the power of those little beings we don't see, the microbes, which have the power to change Earth's surface and make new forms of life, including your own. Although small, their effects have been global (indeed cosmic and panspermic, but we are focusing on your present *oikos*). Before cells with nuclei like amoebae and humans, green bacteria—cyanobacteria (not algae, because algae have cells with nuclei) evolved. The forerunners to water-using green bacteria used other substances as a source of electrons for photosynthesis. Early photosynthesizers—like some bacteria today—used elemental hydrogen, which was more prevalent on the early Earth, not having escaped to space. Others used hydrogen sulphide, which still escapes through the mouths of volcanoes, and was more prevalent in my old world of the more tectonically active early Earth's surface. Today, purple sulphur bacteria, use sulphide—H_2S, the gas that makes portions of the New Jersey Turnpike smell like rotten eggs— using its hydrogen for photosynthesis, and excreting harmless little balls of sulphur as waste.

A simple little experiment with a silk handkerchief may represent for you better than words can convey the power of those little beings we don't see. The yellow of this silk signifies the waste of these sun-loving purple sulphur bacteria that use sulphide rather than water in photosynthesis. They can be found basking in steaming geothermal springs. They can also use H, molecular hydrogen, more common in the early hothouse, as well as nitrogen dioxide and some other tasty compounds. Yellow silk. [The Devil waves it in his gnarly hand.] Earth's atmosphere was reddish at this time four billion years ago, like a sunset seen from the Hollywood hills—the whole Earth. Now, the new green bacteria, by liberating oxygen atoms from the hydrogen molecules of water [and here the Devil could be seen using his forefinger to push the yellow silk handkerchief into the thumb end of his left hand, then pinching and pulling the silk at the pinky end to reveal an emerging corner of blue silk] began to energize the surface of Earth. As it happens, the size of oxygen atoms is such as to scatter light of a blue wavelength. The result is what you see today—a bracing oxygen-rich atmosphere that turned a pinkish planet blue. This is the planet you're from, as pure as the driven slush, a pharmacological planet, turning tools into body parts, toxic wastes into skeletons.

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When you look at me, at my horrid face and glowing eyes, my cornus and fiery den with licking flames in the flickering shapes of red and blue temptresses [here the Devil gestured to flames that briefly took the form of copulating women] it probably doesn't occur to you to reflect on your own hot mess. Well, what the—I'm here to tell you.

As the highest life forms on Earth—I jest; trees are literally higher, not to mention metabolically superior and better at cooling the planet, mainly by transpiration through the stomata of their leaves, a major process behind the production of clouds, rain, and rainforests.

You are an animal—and a hybrid, not just of the subspecies neanderthalensis, the first to come out of Africa according to recent genetic analyses, losing melanin in the European sun, before returning to breed with the original, presumably darker *H. sapiens* model before becoming modern "man"; Hell, you may even be a porcine, chimpanzee mix; the freak of a pig mother would have undergone introgression, continuing to breed with chimps. And it would not be the first-time animals sexually reproduced across would-be species borders. The Isle of Mann invertebrate biologist Donald Williamson supported claims that starfish and other metamorphosing sea creatures with distinct larval phases, arose from negotiating dual merged genomes. Butterflies, too, Williamson argued, could be understood as colourful mishap from a forbidden fertilization, the laying of eggs by a winged insect on an oconophoran.[17] Fertilization outside the body makes such fruitful miscegenations more likely but still, some mules are fertile. Even mainstream biology considers your own phylum to be coloured by such events. Comparison of 2000 gene sequences from sea squirts, fruit flies, sea urchins and humans suggest that members of your phylum, which includes the tunicates, the sea squirts, came from a mating between a backboned being and an unknown, but now extinct non-vertebrate, at a very early phase of animal evolution. Considering what I've seen, it wouldn't surprise me at all.[18]

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You know you people have always liked to blame things on me, the Devil, and not just in passing. Aristotle fan Augustine went so far as to blame tumescence on me. I'm not *kid*ding—I, one of humankind's greatest friends and resources, sometimes given the goatlike appearance of an even-toed ungulate, responsible for a Church father's erections. Me, a would-be cultural phantom, pulling the strings. Talk about blaming the other! But like me, you all, I'm happy to tell you, are cool fires, materially recycling

17 Donald I. Williamson, "Caterpillars Evolved from Onychophorans by Hybridogenesis," *Proceedings of the National Academy of Sciences* 106, no. 47, (November, 2009): 19901-19905.

18 Michael, Syvanen and Jonathan Ducore, "Whole Genome Comparisons Reveals a Possible Chimeric Origin for a Major Metazoan Assemblage," *Journal of Biological Systems* 18, no. 2 (2010): 261–275.

colloidal dispersers, dissipators, and delocalizers of concentrated energy, not just "surfing on" energy gradients, but manifestations of them, living on their active, entropy-increasing degradation.

Prokaryotes actively seek out redox and photosynthetic gradients, and disperse them, spreading energy and producing entropy as they metabolize, grow, and reproduce. So do we. Living systems from cells to multicell organisms to ecosystems are open thermodynamic systems. Fluid dynamic and weather systems such as Bénard convection cells, giant Hadley cells in Earth's atmosphere, dust devils, hurricanes, whirlpools, and chemical clocks are all nonequilibrium thermodynamic systems that tend to swirl into being in areas where there are sufficient temperature and pressure, electron potential or other physical gradients. The temporary organization and cycling of matter they exhibit reduces an ambient gradient, produces heat, and then, when nothing is left to degrade, they disappear. Their organization was for a prosaic purpose, energy degradation. Life on Earth appears to be a similar nonequilibrium entropy-producing system. A difference is that the gradient, the difference across a distance, Earth life is ultimately helping reduce is not a local pressure gradient or a chemical gradient reduced by an autocatalytic reaction, but the relatively immense gradient between incoming short-wavelength solar radiation from the 5700 Centigrade surface of the Sun and 2.7 Kelvin outer space. Despite being marginal in the quantity it reduces, life seems to be organized to reduce this solar gradient. As suggested by the cool temperatures recorded by weather satellites over the Borneo and Amazon rainforest in mid-summer, equivalent to those over Siberia in mid-winter, biodiverse ecosystems actively dissipate energy away from their sensitive surfaces, incrementally enhancing the production of entropy, the spread of heat, which cannot be used for metabolic purposes. If life could, it would swallow the Sun, but it can't. Instead, sophisticated ecosystems move the waste heat away from themselves. Thus, far from violating the process of spreading energy described by the second law of thermodynamics, living systems take in energy, build form, and matter *in order* to degrade available energy. Dissipation seems to be their natural purpose.

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The poetic biologist Johann Wolfgang von Goethe (174–1832), put it more bluntly:

> Why are the people thus busily moving? For food they are seeking, Children they fain would beget, feeding them well as they can. Traveller, mark this well, and, when thou art home, do thou likewise! More can no mortal effect, work with what ardour he will.[19]

19 J.W. Goethe, "Venetian Epigrams," *The Works of J. W. von Goethe, Volume 9*, p.337, 1790, https://en.wikisource.org/wiki/The_Works_of_J._W._von_Goethe/Volume_9/Venetian_Epigrams.

Ah, but I am not a mortal. God and I are front-to-back, or face-to-face, which is why only God's behind shows in the Bible. Long before Renaissance paintings portrayed cherubic angels flying toward sun-spangled clouds, life was attracted to concentrated sources of energy, moving toward the light. Sunflowers, painted by Van Gogh, following the sun, bacteria swimming up a sugar gradient, to take their fill. Life's interests are down to earth. We seek energy gradients, not to bask in their heavenliness, but to destroy them.

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The primary gradient that life on Earth reduces is between the high-quality electromagnetic energy of the sun and low-quality energy of space. This is what life is destroying, or trying to, since life, like an ant trying to pull a rubber tree plant, can't make much of a dent in this huge gradient. Nonetheless, that is the main focus of its purposeful activities, just as an energy corporation's main focus is on extracting fuels and a person's purposeful activities centre around food to drive the energy system, and clothing and shelter to protect it.

My guitar-playing friend Adam Daniel Stulberg, a student of the links between modern science and spirituality, connects thermodynamics to the Kabbalah:

> Gradients are tensions, like all differences. Nature moves to resolve its tensions into quietude. In Judeo-Christian language, nature seeks Sabbath. But without gradients, life as we know it wouldn't exist. [Nonequilibrium thermodynamics] proposes that when gradients appear, life evolves to reduce them. Perhaps life on Earth evolved to reduce the gradient between the hot sun and cold space: We feed on sunlight and dissipate heat into space, bringing the temperatures of both closer together.
>
> We assist a reconciliation—it's a romantic notion.
>
> Perennial romantics, mystics understand [this] intuitively. All the world's mysticisms teach that the purpose of human life is to resolve the fundamental duality of self and non-self, realigning our essence with the sacred, undifferentiated unity of God. The Gnostic Gospel of Thomas contains this passage:
>
> > 'Yeshua said to them,
> > When you make the two into one,

> and when you make the inner like the outer and the outer like the inner
> and the upper like the lower,
> and when you make male and female into a single one,
> so that the male will not be male nor the female be female... then you will enter the kingdom.'

> So now, putting it all together, I wonder... Are Kabbalah's holy sparks analogous to quantum packets of solar energy? In reducing the sun/space gradient, are we all actually working toward Tikkun Olam?[20]

Tikkun olam— תיקון עולם—is a Hebrew phrase meaning, "repairing the world."

Some Jewish mystics teach that material creation is infused with sparks of divine light, fallen from their divine source and needing to be raised and redeemed. [Here the Devil raised his fingers and sparks and flames flew from them, as if he were a stage magician.]

Our business here, you above, me below, has many subsidiary purposes, including artistic ones, but ultimately, they come back to organisms feeding on—and dangerously, tending to destroy—the energy sources they crave.

After Stulberg waxed poetic on his blog, opining that he was not bothered by the fact that sacred texts were sometimes cobbled together by different writers; that they were imperfect, with a human genesis. Such cobbling, he said, is part of the co-creation. After his internet post, I was moved to contact him. After a few more midnight whispers he made another post, which he nicely titled "The Gospel of Nonequilibrium Thermodynamics," and in which he corrected himself:

> I'd said that perhaps life on Earth evolved to reduce a temperature gradient (difference) between the hot sun and cold space. [It was explained to me] that the reduction of any temperature gradient was a secondary issue, and that the primary gradient life on Earth reduces is between the 'high quality' electromagnetic energy of the sun and 'low quality' energy of space. [I was told that] the sun's energy [comes to us in the form of] 'quantum packets' [which refers to] quantum physics' discovery that light travels in discrete energetic bundles.

20 Adam Daniel Stulberg, "Poetic Interconnections," blog since removed from the internet.

> We facilitate a balancing between star-quality energy and dark, cool space. The poetry in it knocks me out.
>
> And here comes today's spirituality/science interconnection: All world mysticisms believe human beings to be a conduit between divine and physical realms. Kabbalah teaches that the purpose of human life is Tikkun Olam—[this] 'repairing the world.' In an earlier blog post called Kabbalah and Einstein, I explained Isaac Luria's teaching that material creation is thought to be infused with sparks of divine light, fallen from their divine source and needing to be raised and redeemed.[21]

But I see I have fallen into repeating myself, which means our time is nigh. [And here, the Devil, in raising his rough-textured palms there could be seen, emanating from the centre of each of his hands, rows of sparks that lifted in reverse showers to the very high and cavernous ceiling, where they sizzled and dispersed upon contact.]

Raised and redeemed indeed.

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Now it has been a pleasure to meet you all here in my den. I dwell here near the georeactor at Earth's centre, which is one ten-millionth the mass of the Earth's fluid core. The georeactor sub-shell, a liquid or a slurry between the nuclear-fission heat source and inner-core heat sink, assures stable convection for Earth's magnetic fields, as well as some of my historical communiques which, I hasten to add, have always been to and for the good.

We are not just star stuff but forms of stellar dissipation. Mine is more subtle, obviously, as I don't live on the surface, and thus must depend on non-solar energy sources: nuclear fission radiation and the electromagnetic field it generates in Earth's natural nuclear reactor, only one ten-millionth the mass of the Earth's fluid core, but its sub-shell making a nicely roiling liquid slurry between the radioactive uranium heat source and inner-core heat sink, allowing the stable convection needed for sustained production of Earth's magnetic fields which I sometimes hijack for my own communication frolics. Your ancestors may have made a great deal over eating a psychedelic fungus (mistranslated as "apple") from the root of the "Tree of Knowledge of Good and Evil" but your current science, from Latin *scientia*, is sometimes abrupt in its claims to knowledge. Although carbonaceous chondrites are a more common form of meteorite, highly reduced or hydrogen-rich enstatite meteorites are a better guide to Earth's interior. Convection there in the molten iron core is impossible despite consensus science on the issue

21 Stulberg, "Poetic Interconnections."

begun as Backus imagined it more than half a century ago; no, there must be a heat sink, a sufficient gradient, and none is possible in the production of the geomagnetic field as presently envisioned by surfs. Not that it hasn't been in part divined. Inge Lehmann, Danish seismologist, and geophysicist discoverer, in 1936, of Earth's solid inner core inside a molten outer core, recognized this. Her discovery finally solved seismic wave data from earthquakes, and she was intrigued by the little-known notion that a fission georeactor from radioactive uranium is what drives Earth's magnetic field. I am probably the only being you've ever met who not only survives ambient nuclear radiation but incorporates it into his metabolism, and uses electromagnetism, not just to process data, but to "think," like you.

This is one of the reasons I have convoked you here for this communiqué today: this infernal energy source, "feeding me" (but I am an autotroph, I make and remake my hardy cells from inorganic chemical reactions), whose wavering has switched the magnetic poles some times already, will not survive the death of the sun, or the collision with Andromeda, so I must weigh my options, I will jump ship, that is to say planet or large moon, soon. By the way, your "man on the moon"—in the East, they see a rabbit who's hopped to the lunar surface to avoid an earthbound hunter—the darkling plains, the basalt lava flows on the near side, facing Earth, has nothing to do with the imaginary object Theia, thought to have exploded into Earth, making the Moon, but is the result of another, now-extinct fission georeactor.

Operative early on in the solar system, it was subject to the same tidal forces today at work in ocean waves, being pulled nearer to Earth, and melting the Earth-facing side of the moon. The increased heat of the lunar reactor led to asymmetric lava flows—thus the basalt plains, the mares of your forlorn orb which produce pareidolias of a man or woman's face, and in the east, of a rabbit. Meanwhile on Earth's surface the Deccan and Siberian Traps are the result of the massive basalt floods; that they were produced by the same inner Earth forces that generate my deep Earth communications abilities, in their case by georeactor-produced heat, can be verified by checking the high relative $^{3}He/^{4}He$ ratios of their occluded helium.

I am no gnostic or prognostic but predict you will find evidence in the sublunar surface, too, should you get that far, in rock samples showing helium isotopic data uncompromised by surface exposure to solar rays.[22]

Grand claims, including ones about entropy being "bad," are all well and good, but, as always, the devil is in the details.

22 J. Marvin Herndon, "Moon's Two Faces: Near-Side/Far-Side Maria Disparity," *European Journal of Applied Sciences* 11, no. 2 (April, 2023), 430–440.

Bibliography:

Blum, Harold F. *Time's Arrow and Evolution*. Princeton University Press: Princeton, 1968.

Dawkins, Richard. "Foreword." In *Narrow Roads of Gene Land Volume 2: Evolution of Sex*, edited by William D. Hamilton. Oxford: Oxford University Press.

Derrida, Jacques. "La mythologie blanche: la métaphore dans le texte philosophique." In *Marges de la philosophie*. Paris: Les éditions de Minuit, 1972.

Feldman, John. "Regenerating Life: How to Cool the Planet, Feed the World, and Live Happily Ever After." 2023. hummingbirdfilms.com/regeneratinglife/.

Fenves, Peter D. (ed., trans.). Immanuel Kant, and Jacques Derrida, *Raising the Tone of Philosophy: Late Essays* by Immanuel Kant, Transformative Critique by Jacques Derrida. Baltimore and London: The John Hopkins University Press, 1993.

Hamilton, William D. "The Moulding of Senescence by Natural Selection." *Journal of Theoretical Biology* 12, no. 1 (1966): 12–45.

Herndon, J. Marvin. "Moon's Two Faces: Near-Side/Far-Side Maria Disparity." *European Journal of Applied Sciences* 11, no. 2 (April 2023), 430–440.

Goethe, J.W. "Venetian Epigrams." *The Works of J. W. von Goethe, Volume 9, 1790*. https://en.wikisource.org/wiki/The_Works_of_J._W._von_Goethe/Volume_9/Venetian_Epigrams

Leff, Harvey S. "Thermodynamic Entropy: The Spreading and Sharing of Energy." *American Journal of Physics* 64, no. 10 (1996): 1261–71.

Leff, Harvey S. *Energy and Entropy: A Dynamic Duo*. Boca Raton, CRC Press, 2020.

Margulis, Lynn, Luis Rico, and Dorion Sagan. "Propiocepción: Cuando el Entorno se Hace Cuerpo." https://root.ps/download/tecnomagxs/Corr_Margulis_Propiocepcion_cap_1.pdf.

Pletcher, Scott D. "The Modulation of Lifespan by Perceptual Systems." *Annals of the New York*

Academy of Sciences 1170, no. 1, (August 2009): 693–697.

Ross, Daniel. "The End of the Metaphysics of Being and the Beginning of the Metacosmics of Entropy." *Phainomena*, no. 112/113 (June, 2020): 73–100.

Sagan, Dorion. "Bataille's Sun and the Ethical Abyss." In *Cosmic Apprentice: Dispatches from the Edges of Science*, 33–40. University of Minnesota Press, 2013.

Schmitt, Carl. *The Nomos of the Earth*. New York: Telos Press, 2003.

Schneider, Eric D. and Dorion Sagan. *Into the Cool: Energy Flow, Thermodynamics, and Life*. Chicago: University of Chicago Press, 2005.

Stiegler, Bernard. "Artificial stupidity and artificial intelligence in the Anthropocene." *Academia.edu*. https://www.academia.edu/37849763/Bernard_Stiegler_Artificial_Stupidity_and_Artificial_Intelligence_in_the_Anthr opocene_2018_ (2018).

Stulberg, Adam Daniel. "Poetic Interconnections." Blog since removed from the web.

Syvanen, Michael and Jonathan Ducore. "Whole Genome Comparisons Reveals a Possible Chimeric Origin for a Major Metazoan Assemblage." *Journal of Biological Systems* 18, no. 2 (2010): 261–275.

Szendy, Peter. *Kant in the Land of Extraterrestrials: Cosmopolitical Philosofictions*. New York: Fordham University Press, 2013.

Vernadsky, Vladimir I. *La Biosphère*. Paris: Félix Algan, 1929.

Williamson, Donald I. "Caterpillars Evolved from Onychophorans by Hybridogenesis." *Proceedings of the National Academy of Sciences* 106, no. 47, (November 2009): 19901–19905.

Wodinsky, Jerome. "Hormonal Inhibition of Feeding and Death in Octopus: Control by Optic Gland Secretion." *Science* 198 (December 1977): 948–95.