



What might “planetary intelligence” entail? One aspect of intelligence, at least of our sapient sort, is the capacity to be aware of—and thus to be able to author—our own biographies. We are biographical beings. We learn from our pasts, in order to plan for our futures. In some ways, we can view our species as bequeathing such an aptitude to our planet itself, as it ploughs through deep time and twirls through deep space. Through us, a planet becomes autobiographical: capable of gauging its deepest past and tracking the unfolding complexities of the present, so as to select between possibilities and prospects for tomorrow. Through our globe-girdling array of sensors and simulations, our planet might just be becoming responsible for itself. That is, capable of authoring its own future and avoiding catastrophe. But, sapience always presupposes stupidity: the ability to learn from one’s errors entails having made them. No one is born wise, after all. It is a status earned through demonstrating willingness to correct grave—sometimes catastrophic—mistakes. Accordingly, assuming that we might be living during the prehistory of a planetary sapience, this talk explores the necessary episodes of planetary stupidity requisite for this. It presents a history of grand, often shocking, follies: of proposed geoengineering projects and other ambitious schemes, all of which would have been catastrophic had they been fully implemented. But, ultimately, the message is hopeful: stupidity and intelligence are sides of a coin, and inspecting the errors of the past throws into relief just how far we’ve already come in our quest to coalesce forms of sapience at scales extending far beyond our skulls.

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## EDITORIAL

In this talk, Moynihan explores the evolution of humanity’s understanding of Earth, from a divinely designed realm to a planet shaped by impersonal forces and increasingly by its own inhabitants. The talk traces how our awareness of Earth’s history and potential futures has developed, marred by significant errors and misinterpretations, towards a nascent planetary self-awareness.

Early views saw Earth as a perfect creation marred by the Biblical Fall, but the emergence of geology in the 1700s revealed a vast, prehuman history shaped by impersonal forces. Comte de Buffon’s theory of a cooling Earth and the recognition of humanity’s potential to alter its course marked early attempts to understand Earth’s deep past and future.

The 19th century saw the first visions of planetary climate regulation, but also a failure to anticipate the negative consequences of human influence on the environment. Early attempts to depict the Earth from space and to conceptualize the impact of humankind on the planet’s history reveal an evolving awareness of humanity’s role as a geological force.

The understanding of coal as fossilized sunshine led to concerns about its depletion, yet early theories lacked an understanding of the link between CO<sub>2</sub> and global temperatures. The mid-1800s witnessed the discovery of the Greenhouse Effect and early speculations about the co-evolution of life and the atmosphere, alongside some of the first acts of climate denialism.

The concept of a “Psychozoic Era” emerged, describing a new geological age dominated by human influence. Figures like Vladimir Vernadsky and Pierre Teilhard de Chardin saw the Earth evolving a “noosphere,” or a global consciousness, with humanity as a major geological force. However, this view was often coupled with an overconfident belief in humanity’s control and a dismissal of potential for catastrophe.

As understanding of Earth’s climate history grew, with the recognition of Ice Ages and the role of CO<sub>2</sub>, a more nuanced picture of the planet as a dynamic, self-regulating system emerged. Yet, this understanding did not always temper humanity’s hubris, with some advocating for radical schemes to exploit fossil fuels and transform the planet.

The latter half of the 20th century brought a deeper understanding of planetary atmospheres, partly fueled by the shock revelation of Venus’s hellish environment, leading to a greater appreciation of the delicate balance of Earth’s climate and the potential for human actions to trigger catastrophic changes.

The search for extraterrestrial intelligence (SETI) further expanded this perspective, prompting a shift from seeking intentional signals to looking for the unintentional footprints of life in the form of transformed environments. Figures like Lem contemplated the nature of intelligence and the possibility that advanced civilizations might exist in ways that are unrecognizable to us.



Thank you everyone for taking the time to be here. I do appreciate it. To all the studio researchers, it's been an absolute pleasure meeting you over the past couple of weeks, and I look forward to continuing the conversation with you.

So, today, I've titled my talk, with a bit of a devilish grin, Planetary Sapience & Planetary Stupidity. And I hope I'll be able to flesh that concept out a bit. The subtitle is: "A Bildungsroman for The Baby Noosphere". For those of you that aren't familiar, a bildungsroman is a narrative form showing moral and spiritual growth from childhood to adulthood. So, keep that in the back of your minds. So, without further ado.

## PART 1: INTRODUCTION

01:41

Part 1: Introduction

Today I want to begin with time travel of the type you will have performed since waking up today. I'm talking about what psychologists call mental time travel, or the ability to recall the past and predict the future. This capacity allows us not only to keep track of our biographies, but also to a degree, to actively author them. But is it possible to imagine an entire planet—ploughing its way through deep time—gaining such an aptitude?

That is, the faculty of recollection and foresight? Until recently, I would argue, our planet was amnesiac. That is, no part of it was reflectively aware of the place of the present relative to the established past nor the expected future. But then peculiar animals emerged, capable—no matter how imperfectly—of cooperation, abstraction and invention. In the last blink of geologic time, through the collaboration of these animals with their increasingly cunning artifacts, this state of planetary amnesia has faltering begun being cured. That is, through our artifacts, our planet is becoming aware of its own unfolding biography. In our fallible attempts to model our world—alongside our growing legion of sensors—The Earth system has developed a way of recollecting its deepest past and tracking the changing complexities of its present so as to forecast its furthest future.

Through the collective endeavors that we refer to with words like 'climate science', the world becomes apperceptive, even autobiographical. But intelligence is no disembodied spook but a formidable physical force. In many ways, it is best thought of as a tendency to manipulate its environment. This way, intelligence only continues and intensifies what life has been doing, albeit blindly, since its inception aeons ago. For example, the oxygen you are breathing now is through and through, the products of ancient life. Which is to say, it is the product of time, of many cumulative prior steps.

Unlike things that can effortlessly spawn anywhere or anywhen, regardless of previous chains of events, the products of life are necessarily products of histories. The thing with histories, though, is that they open leeway for contingency. This refers to when past events could have gone otherwise, producing a very different present. Only by studying this can we grapple with the ways the future, likewise, might unfold very differently, hinging upon events in our fleeting present.



In our personal lives, mental time travel allows us to become responsive to risk, to anticipate, mitigate, and avoid. Likewise, at the level of the planet, no matter how haphazardly, some progress has been made towards mapping the splaying possibilities ahead so as to steer away from catastrophe. If achieved more fully, this would be a form of planetary sapience: of prudence, even wisdom. But insight, by necessity, is hewn from prior idiocy. Put differently, wisdom is only ever forged from previous error, because it can only be earned through the precedent of willful revision. Accordingly, the prehistory to planetary sapience, as I want to explore today, is often a story of planetary folly. Indeed, life may have been perturbing its planet for billions of years, but technological life is doing so with unprecedented intensity, presenting unforeseen problems.

The projects of predicting nature, it turns out, so as to better manipulate its forces and manage its risks, itself generates its own novel forms of risk. We might call these anthropogenic, the threats indigenous to an increasingly artificial world. Nonetheless, I hope to accentuate today that merely by acknowledging all this, we've already come very far. Otherwise, all too easy to overlook, only assuming history's vantage throws this into relief. After all, ideas and worldviews, like organisms and ecosystems, are things produced only by abundant time. As such, it took time for our kind to realize we were made by deep time. Retracing this gives us a grasp of the headroom on possibilities for future deepening of our insight.

So let's explore the history of growing awareness that we live on an increasingly 'artificial' planet. Or the story of intelligence catching sight of itself as a force that artificialises not only itself but also its world. So I want to take you on a journey, starting with the very small scale that is the planetary and hopefully ending up somewhere else.

## PART 2: ARTEFACT OR ANCIENT FACT?

07:47

Part 2: Artefact or Ancient Fact?

Of course, not too many generations ago, everyone in this room would have assumed we were already living on an artificial Earth. Back then, it was agreed that everything was designed by deity. As Thomas Browne wrote in 1642: 'all things are artificial, for nature is the art of God.' Throughout the 1600s, people were so convinced of this that mountain ranges, crags and canyons actively puzzled them. Why, they asked, did the perfect architect not create a perfect sphere, uniform and smooth? Why the unsightly blemishes, the pockmarks and imperfections? To explain this, the presence of mountains was neatly blamed on the Biblical Fall. The Earth, it was assumed, was once a perfect sphere. But Adam and Eve, biting the apple changed all that, leading—as punishment—to our currently imperfect, unsightly world.

Nonetheless, as the 1700s opened, geology began consolidating as a mature science. It became gradually apparent that our exuberant Earth was not a product of one act of straightforward design, but, instead, of impersonal forces acting throughout a sprawling, prehuman history. A history wherein conditions in the past had once been very different from those now prevailing. Which naturally invited the question: how might conditions change again in the future?

In the 1770s, the French polymath Georges Buffon presented the first theory comprehensively predicting both the past and future of the Earth system, based on the rudimentary hypothesis that the planet was irreversibly losing an original finite fund of internal heat. Buffon assumes that the Earth had started in a molten state before crusting over and eventually cooling enough to become habitable. The conclusion was that global temperatures would steadily, irreversibly decline over time until the Earth would freeze completely and die. Buffon was also amongst the first to locate *Homo sapiens* as a specific phenomena that emerged from the Earth system's past, and will also eventually disappear from it in the future—entirely as a result of this secular material process of cooling.

Moreover, he was also amongst the first to conceive of life—through the actions of human civilization—as an agency within this planetary biography. That is, as potentially altering its future course. Buffon conjectured. He wrote: "Nothing seems more difficult than to oppose the progressive cooling of the Earth and to raise the temperature of the climate; however, humanity can do this, and has done this." In an era long before thermodynamics and the causal mechanisms dictating global temperature were understood, Buffon concluded: all we need to do is keep increasing the population of humans and livestock, insofar as organisms themselves are, in his words: 'nothing so much as little furnaces of heat.' This way, he realised, we can achieve 'life extension' of the biosphere, and buy some more time before our globe's terminal freezing.

## PART 3: DISTURBING THE GLOBE

11:33

Part 3: Disturbing The Globe

Around this time, also, the first visions of planetary climate regulation and control emerge. In 1799, the German philosopher Johann Fichte proclaimed scientists would eventually become so proficient at predictive calculation they would be able to infallibly anticipate all developments within the Earth's system. Envisioning a perfected system of planetary mitigation, Fichte pictured a future wherein disasters are ex-

haustively foreseen and forestalled. He imagined a world eradicated by hurricanes, earthquakes, volcanoes and plagues. All wilderness would become populated, he claimed. Every landmass cultivated.

Fichte referred to this as the exhaustion factor referred to this exhaustive artificialization story as the completion of the formation of our planet. What Fichte didn't anticipate, of course, was the ways in which the growing influence of human civilization might alter the environment in ways that might, in turn, negatively impact life itself.

Nor did he foresee that reverse engineering nature's laws leads to the forecasting of hurricanes, yes, but also the invention of hydrogen bombs. It wouldn't be long until such grand visions trickled into fiction. For example, in his 1805 'The Last Man', the French author Jean-Baptiste de Grainville imagined the final generations of humanity using vast machines to shift continents and extract the final nutrients from an aged, decaying Earth. They "level mountains", "fill up valleys", "penetrate into the bowels of the globe", and, using colossal "engines", move "aside the Rhone, the Seine, and the Danube," to drain oceans.

Unsurprisingly, the early 1800s also saw the first proper attempts to depict the Earth as it would look from outer space. That is, as an integrated physical whole, against the void of space.

In tandem, scientists began seriously inquiring whether the impacts of humankind might qualify as the introduction of a new force within geohistory. Talking of civilization as a "peculiar and unprecedented agency," one geologist provoked, he wrote: "If an intelligent being, therefore, after observing the order of events for an indefinite series of ages, had witnessed so wonderful an innovation as this, would he cease to assume that there was permanency in the laws of nature?"

Around this time, also, geologists realized that coal—the dynamo behind the building Industrial Revolution—is formed from petrified plants and is thus, essentially, fossilized sunshine. It is, thus, a non-renewing resource, accumulated only over aeons. Fossil fuels and thus an enormous, yet fundamentally finite stock. Accordingly, luxurious or wasteful burning of coal came to be cast in a newly negative light.

For context, it was common at this time to carelessly leave vast piles of coal burning, wastefully, outside mine entrances, as this was simply cheaper than moving or managing these piles, and they would burn through the day and the night. Economists and geologists accordingly began insisting people try keeping coal in the ground, or at least, burn prudently. In response, panic ensued concerning the future of civilization on Earth.

Of course, this was long before any understanding of the link between atmospheric CO<sub>2</sub> and global temperatures. These were, after all, very Victorian fears based on overconfident forecasts of the physicists of the day, concerning there being, as John Tyndall said in 1866: "No prospect of any substitute being found for coal as a source of motive power." Such that, assuming this, squandering fossil fuels in the present became recast as inflicting "an irremediable injury upon posterity."

As William Buckland wrote: "We must not by wanton waste, destroy the foundations of the industry of future generations." Indeed, there was as yet no real awareness that industrial activity might severely perturb the planet. Thankfully, however, though the motivation was completely misguided, the proposal to outlaw entirely wasteful coal burning would not have unleashed irreversible harms entirely unforeseen by those doing the proposing. The same, however, cannot be said for other daring prescriptions from the time.

#### PART 4: DISINFECTING THE SKY

16:33

Part 4: Disinfecting The Sky

The middle of the 1800s also saw the very first glimmerings of biogeochemistry, and what we now call climate science. This takes us to what might simultaneously be the first announcement of anthropogenic global climate change, and one of the very first acts of climate denialism. Which brings us to the 1856 public lectures of the now-forgotten Belgian chemist Cornélie-Jean Koene.

Here, Koene became the first to realize that the early Earth likely lacked oxygen, and to speculate upon the co-evolution of life and the planetary atmosphere over time. From the presence of oxidized metals in primitive rocks, Koene correctly realized that the primordial Earth lacked free oxygen. Decades ahead of his time, Koene inferred that the first life forms were anaerobic. Specifically, he imagined simple plants initially emerging before dumping tons of oxygen into the atmosphere via photosynthesis. He pictured a youthful planet covered in dense forests and gigantic plants. Koene then conjectured: "During this development, plants took in carbon and released oxygen. As the quantity of the latter increased, it permitted in its turn the appearance of simple animals. Over geologic time, increasing atmospheric oxygen promotes the centralization and complexification of the nervous system, eventually culminating in contemporary humankind."

Since life's emergence, he reasons, there has been constant "decrease in carbon dioxide and steady increase in oxygen." This, he thought, was due to increasing populations of animals "fixing" carbon in their bodies. Aware that coal burning reintroduces CO<sub>2</sub> into the atmosphere, Koene nonetheless remains confident this wasn't enough to counteract secular decrease in carbon levels, he wrote: "Consider the enormous quantity of carbon fixed annually by farming livestock, and you can begin to understand that the combustion of coal is far too limited to balance them all." Though Koene was not aware of the Greenhouse Effect, he nonetheless conjectured a vague causal connection between dwindling CO<sub>2</sub> and global cooling. Accordingly, he forecast: "As a consequence of this decrease of carbon dioxide, there will come a period of dieback characterized by continuous cooling of the planet, which will end with the extinction of the human species." He concluded: "in cold and hunger, all life will perish." Via "ballpark calculation" he predicted this would happen in the course of ten centuries.

But here is a final, perverse twist. Koene believed that the increase in livestock and urban populations promoted pathogenic "miasmas", combined with the reduction in CO<sub>2</sub>, making vegetation more susceptible to blight. That is, the planet, he thought, is becoming more diseased, creating novel pandemics unknown to our ancestors. The 1850s, after all, were a decade of deadly global cholera outbreaks spreading from Bengal to Tokyo. Thus, Koene announced, to stave off extinction, we need to release "disinfectants" into the atmosphere. How do we do this? Koene proclaimed: "Will there ever be a way to prevent the putrefaction of the cities? We need to release vapors to destroy miasmas. And how do we do this? You can do this with coal! When coal burns, it produces a gas called sulfuric acid. Sulfuric acid is a disinfectant able to destroy miasmas, the germ of our evils."

Accordingly, Koene realized it is thanks to industrial emissions that population-dense centers are habitable at all. He wrote: "Coal burning makes great cities habitable, and it watches over our health in the measure to which we put coal to use. Unfortunately, the quantity of sulfuric acid released from chimneys is insufficient to sanitize the air of our population centers.

We must then burn more sulfur where the miasmas are worst." Koene was insisting this in a context wherein citizens had already begun complaining about pollution from chemical factories. He ruthlessly attacked the complaints of these, in his words, peasants. He said: "It makes one laugh to hear talk of deleterious gases coming from factory chimneys. It is astonishing to see people prejudiced about such things. There should be cause for rejoicing when these gases are released into the atmosphere, because all of them are useful and beneficial". At this point, the scribe, recording Koene's lecture, noted that his audience erupted into applause.

So, though he was decades ahead of his time in speculating on the fate of humankind in connection with long-term changes in Earth's atmosphere due to biogeochemical feedbacks, Koene also provides an instructive case of egregiously motivated reasoning. He was, after all, a patent-holding, fully-invested member of Belgium's industrialist class.

## PART 5: PSYCHOZOIC AGE DAWNING

22:03

Part 5: Psychozoic Age Dawning

With great irony, in the same year as Koene's lectures—that is, 1856—the American scientist and women's rights campaigner Eunice Newton Foote, discovered and described the Greenhouse Effect. She noted that carbon dioxide retains heat, and thus, an Earthly atmosphere with more of it would be warmer. Her pioneering contribution was, however, overlooked for decades, likely due to sexism. In the following decades, an increasing number of geologists noticing humanity's growing impact on Earth's systems began proclaiming the dawn of a new geologic age, one dictated by forces unleashed primarily by humans.

Various names were proposed. James Dwight Dana wants to call it the Era of Mind. Antonio Stepney wants to call it the Anthropozoic Era, and Joseph LeConte titled it the Psychozoic Era.

Dana argued that this was the culmination of a long-term evolutionary trend, that is, towards centralization and intensification of the organism's energies in an increasingly hefty brain. Evolution moves "headward", Dana argued. He called this "cephalisation." Inspired by this theory, the term psychozoic age caught on. Constructed from "psyche" meaning mind and "zoe" meaning life, it denoted that era wherein living matter's flows are dictated by mental forces.

Comparing telegraph wires to nerve fibers, the German philosopher Ernst Kapp, argued in 1877 that, in the form of a globalizing communication network, the world was growing its own nervous system and itself becoming "cephalised."

This, however, was an era enamoured with damaging myths of inexorable progress. Such that few voices highlighted any real potential for negative side effects of increasing anthropogenic perturbations within the Earth system. Instead, European writers heralded the new "Psychozoic Era" as evolution's inevitable culmination, whilst predictably positioning themselves as its pinnacle and callously celebrating the accelerating destruction of wild ecosystems. Such confidence was reflected in

wider assumptions about the place of intelligent life in the universe. At this point in time, it was commonly assumed that all terrestrial planets are necessarily the abodes of intellectual life.

In turn, it was largely presumed that all planets follow a more or less identical developmental story. Accordingly, different planets weren't thought of as having different histories, but were thought of as earlier or later stages of the same basic historic arc. Such a schema, importantly, evidences complete insensitivity to the potential for catastrophe or contingency at planetary scale. Based on the then-current nebular hypothesis of Solar System formation, that cloud of gas condenses inwards and precipitates planets on the way in, this led to the assumption that inner planets are younger and outer planets older. Accordingly, Venus, being closer to the sun, was imagined to be a younger version of the Earth, potentially undergoing something like our own Carboniferous period. This illustration is actually someone attempting to depict what Venus would look like in the 1910s. By the same token, Mars was presumed a "more mature" planet, thus enabling a glimpse into Earth's own future. This invited the question: has Mars maintained and sustained its own Psychozoic Age?

During the decades straddling 1900, numerous scientists answered in the positive. Most famously, the astronomer Percival Lowell claimed that he had spotted canals on Mars: evidence of vast geoengineering works conducted by an ancient, more advanced civilization as means to irrigate and extract the final drops of nutrition from their geriatric world.

In 1907, the prominent American sociologist Frank Lester Ward even argued that we could forecast the future length of Earth's own Psychozoic Era by measuring how long Mars had already been in the thrall of its own equivalent. Using best available knowledge, Ward estimated Mars was 96 million years old and the Earth some 72 million. Subtracting the difference, Ward claims this means Earth has at least 24 million years of Psychozoic future ahead of it. Triumphant, he concluded: "Man has thus only begun to exist. His history is but the threshold of the Psychozoic age. The whole of that immense period lies before him." All this, of course, demonstrates insensitivity to the suggestion that a technological civilization in perturbing its planetary environment might cause unwanted consequences. An incredulity, in other words, regarding contingent or catastrophic events, which might derail the golden future of civilization at planetary scale.

## PART 6: FAILING STRUCTURE OR STURDY HOME

27:39

Part 6: Failing Structure  
or Sturdy Home

However, during this time, as the 1800s shaded into the 1900s, understanding had begun coalescing regarding evidence for numerous periods of global freezing or Ice Ages. This came from glacial deposits, which are mineral markers indicating that glaciers once glided and grinded over a landscape, which proved much of the Northern Hemisphere was once almost entirely buried under ice. From this, various scientists, such as the Illinoisan geologist Thomas Chrowder Chamberlin, began seeing issues with the old theory of a simplistic decline in global temperatures across deep time.

The older model, going back to Buffon, assumed the Earth was like a hot Christmas pudding dropped into snow: rapidly losing its thermal fund to space's void. Chamberlin, however, began seeing issues with this notion of, as he called it, a "sliding down the scale": from "excess to emaciation", from "too hot" to "too cold", over Earth's history. Building evidence for multiple Ice ages would support the theory of "simple decline" only if glaciations came exclusively later in Earth's history. But Chamberlin realized it appeared pulses of planetary freezing occurred extremely early too: prior to the Cambrian, precisely when the climate on the older model was meant to be unequivocally hotter.

From this, Chamberlin developed a hunch that the Earth was older, sturdier, & more self-regulating than the prior picture of a heated ball losing its vital warmth in nose-dive decline. The glaciers provoked in Chamberlin an interest in climactic shifts, past & prospective. Our planet, he realised, is no "failing structure", but a dynamic balance, stalwart but sensitive. A complicated equilibrium: one capable of maintaining balance over vast tracts of time, but also of severe oscillations.

Returning to the earlier discovery of the Greenhouse Effect, Chamberlin became one of the first to argue that atmospheric CO<sub>2</sub> is the major factor governing shifts in Earth's climate over the long-term. He also became one of the first to presciently make warnings about the ramifications of civilisation's growing appetite for coal. He declared in 1903: "It is even possible that the climate of the future is much dependent on the agency of man such that hopefully he will, with altruistic purpose, control his action with a view to its bearing on the generations that may live tens of thousands of years hence." He continued: "Man's control has not thus far involved much recognition of the complicated interrelations of organisms & of the consequences of disturbing the balance in the organic kingdom, & he is reaping, & is certain to reap more abundantly, the unfortunate fruits of ignorant & careless action."

Nonetheless, Chamberlain remained hopeful a "more sympathetic attitude is developing", one which may one day be worthy of the name "Psychozoic". Yet such an attitude was hardly yet mainstream. If anything, the message that Earth's climate hadn't always been simplistically cooling—but instead has ways of maintaining itself—increased confidence that our planet was sturdy, almost invincible home.

By prolonging prior limits on our Earth's habitable past, the new theory of long-term self-regulation—as opposed to rapid cooling—radically lengthened the past during which life must have been evolving in one unbroken chain. Accordingly, many in the early-1900s, induced forwards to forecast an equally secure future for life on Earth. As Edwin Conklin said in 1921: "...this enormously long past history leads us to believe that the future will be equally long."

From this, some scientists even proclaimed we needn't worry too much about home-grown catastrophes. The only threats to the future of life, they argued, come from extremely rare astronomical mishaps, such as collision with a passing star. As James Jeans in 1930 said: "such events seem very improbable. Let us disregard them all." Or, as George Pokrovsky said in 1935: "An increasingly peaceful future is opening up for our planet. We don't have to be afraid of unexpected, sudden catastrophes."

## PART 7: IMMOLATING MINES, DRAINING OCEANS

32:32

Part 7: Immolating Mines,  
Draining Oceans

In such a context, others, also aware of the link between coal burning and global warming, arrived at far more brash conclusions. In his best-selling 1908 *Worlds in the Making*, the Swedish physicist Svante Arrhenius (the period's leading voice on climate science) concluded that unrestricted coal-burning would be good for the planet's future: because, he thought, hotter climates would bring "more abundant crops" for a "rapidly propagating mankind".

But Arrhenius's conclusion was far from the most shocking from the period. In 1927, William Abbott, an influential American engineer & businessman, travelled the US delivering lectures. During these talks, he, like Koene a generation before, welcomed industry's accelerating use of fossil fuels. Why? Because he had hastily concluded, like Arrhenius, this could only benefit the world, by making climates more clement.

But, for Abbott, accelerating consumption wasn't enough. Estimating there are several trillion tonnes of carbon still locked underground globally, he reasoned that this storehouse, if "returned to the air", could increase atmospheric levels tenfold.

Abbott announced such a dramatic increase in carbon dioxide would double Earth's arable surface, transforming polar countries into temperate paradises. He envisioned perpetual summers, jungles in America's north-east, & unprecedented crop yields, all to support humanity's "increasing population". Abbott even prophesied tropical animals, such as elephants, somehow miraculously returning to North America, becoming "garden pests." Accordingly, Abbott reached his action plan. He said: "Let the nations of the Earth unite & say that the treasures of carbon, more precious than diamonds, now locked up in Nature's storehouse be restored at once to useful active circulation. This is to be accomplished by burning coal seams in-situ. How? Rebuild the air shafts of old mines, apply the torch below, and make a roaring furnace of the interior. Drive entries through thin seams & burn them out too. If some useful heat may be realised from the emergent gases [...], all well; but do not regulate the fire to the varying demand of power; let it rage day & night. Carbon dioxide is the product. Power is incidental."

Yet it was not only American businessmen proposing such radical schemes. Over in Soviet Russia similarly emboldened proposals were being produced. Boris Petrovich Weinberg was a Russian physicist, one of the first scientists to propose the idea of a maglev train. In 1927, he published a 'Scientific Fantasy' in a forgotten Siberian science journal. The title? 'On the Twenty-Thousandth Anniversary of the Commencement of Ocean Destruction Projects: A Historical Outline of Humanity from Prehistory to the Year 22,300.'

The 'Scientific Fantasy' recounts humankind's prehistory & history from the distant future's perspective. From the vantage of 23,000 AD, we learn that history's sweep is most sensibly periodised in terms of transitions between energetic regimes: so, from the pre-industrial 'Period of Muscular Energy'; to the fleetingly brief 'Period of Coal', stretching from 1700 to 2300 AD; to the 'Period of Solar Energy' thereafter. The past is also periodised by Weinberg in terms of extent of intentional control over the Earth system. We learn that "partial improvements to the Earth's surface" initiated with the "Coal Period", whilst "major works" began toward the end of the 20th century. Weinberg writes: "Already during the early Coal Period, the question of expanding the area on which [humanity] could settle arose". "[Attention] began to turn increasingly to the three quarters of [Earth's] surface that were useless from the perspective of habitation & cultivation..." Or, in other words, the 70% of Earth covered by ocean.

Weinberg continued, writing: "Therefore, at the end of the 20th century, the Earth Improvement Committee decided to definitively address the issue of developing methods for the destruction of oceans, and, in 2007, founded the special Department for the Eradication of Oceans." Thus the multigenerational task of draining the oceans begins. Weinberg passes briskly over minor "climactic" alterations that might occur during this period. Eventually, around 10,000 AD, the oceans are gone.

With Earth completely drained, the world's entire surface can be levelled & "cultivated". Weinberg imagines human population reaching "280 billion"; nations & languages merging, wars ceasing. Apparently, Weinberg adds, only a fraction of



species “from the entirety of the plant & animal kingdoms have been preserved” in “80 nature reserves”. But various replicas & simulations thankfully more than compensate, as he wrote: “for the almost complete absence over the last 10,000 years of that ‘communication with nature’, which many people of former times considered the main source of happiness.”

So here, in this scientific fantasy, the technosphere is imagined exhaustively consuming the biosphere: the perfect act of ecophagy. To be clear, Weinberg was intending this as a utopia, and it was listed as such in the Soviet catalogs.

## PART 8: SUPERORGANISM REX

In 1910, the American entomologist William Morton Wheeler noticed something profound. Antheaps function much like individual organisms. For Wheeler, just as cells cooperate to create an organism, individual organisms can cooperate to create a “superorganism”, each more potent than the sum of its parts. Wheeler implied that evolutionary history can itself be understood as the production of increasingly complex wholes, via the integration of previously separate parts. So, he was quite ahead of his time. The evolutionary major transitions that was later theorised began here. But in an era of burgeoning collectivism, it became salient to ask: is an increasingly globalised & interconnected humankind itself producing a sort of “superorganism”?

Authors began speculating what this might entail. One particularly electrifying example came from the pen of the long-forgotten socialist author Lionel Nimmo Britton. It is called ‘Brain: A Play of the Whole Earth.’ The play’s blurb summarises the plot very well. It says: “A Brain is constructed in the Sahara Desert—presently It grows larger than the Desert—out of pure mechanism, by the whole of the human race. It controls the whole activities & does all the thinking of the world.” A stunning piece of high modernist weirdness, Britton’s play boldly provides an early speculation on the construction of artificial superintelligence. It imagines every human becoming coordinated, like individual neurons, to partake in the titular Brain: which swells to cover landmasses. Eventually, perfect cooperation is achieved.

In the play, Britton, an ardent communist of totalitarian bent—he tried to leave Britain to go to Soviet Russia, but wasn’t allowed—actively celebrates the consequent erasure of all human individuality. After all, for a “superorganism” to achieve higher-level coordination, it demands its lower-level units sacrifice all prior autonomy. So, this passage is quite illustrative of the end of the play: “Brain dominates the life and thought of the world. It concentrates the life and thought of the world.”

Others, however, portrayed similar trajectories negatively. For example, Gaston de Pawlowski, who wrote a 1912 scientific romance envisioning a planetary hivemind emerging, unintentionally, from global flows of exchange. Where once humans cooperated to achieve human ends, this cooperation becomes gradually & imperceptibly usurped: mutating into mere means for the upkeep of this “monstrous & unconscious” superorganism. This “New Leviathan”, symbolised here as a coiling serpent by Dutch artist Leonard Sarluis, is described by Pawlowski as: “superior to humans & enveloping them like the cells of a gigantic body.”

What’s more, in the wake of the continent-spanning paroxysm of World War I, there understandably emerged darker visions of the impacts of an increasingly volatile civilisation upon its globe. For example, Alfred Döblin’s 1924 novel, ‘Mountains Oceans & Giants,’ which depicts a heavily globalised future civilisation suffering overcrowding. In response, a plan is hatched to melt Greenland’s icecap, so as to create more living space. This is to be accomplished by wielding a mysterious, new force of nature recently-discovered by physicists. The icecap is melted, to disastrous results, as the force somehow unleashes an all-consuming environmental cataclysm, rippling across the entire Northern hemisphere. Strange organic growths spread outward from Greenland, like a continent-spanning tumour, causing all living matter it contacts to start mutating & merging in novel, malignant ways.

Or, to take a similar example, Alfred Gurr’s forgotten ‘Tuzub-37: The Myth of the Grey Humanity’—written from 1930s Nazi Berlin—which pictures a distant future where exhaustive ‘ecocide’ triggers global extinction. A protest against Hitlerianism, Gurr imagines a human species that has become completely “grey”, homogenised, & undifferentiated. All individuality is liquidated. This is reflected, externally, in an all-out assault on the remaining recalcitrance of the natural world. The planet’s entire surface is smoothed: mountains levelled, oceans filled, thus fulfilling earlier Christian longing for a prelapsarian planet without mountain ranges. In the book, various calamities ensue, as the atmosphere becomes poisoned; eventually, everything organic has to be replaced by inorganic machine. In the end, an increasingly toxic atmosphere causes even these final machines to malfunction: to become mad & destroy each other, one by one.

## PART 9: NOOSPHERE

Early examples in the genre of ‘cli-fi’, these previous speculative scenarios, like Gurr or Döblin, evince fledgling awareness of the catastrophic potentials of anthropogenic



climate disturbance. Yet, of course, there was no clear stipulation of causation here: only impressionistic, poetic conjecture. Yet, during the interwar years, the field of biogeochemistry was coming of age. Providing a far more detailed picture of the ways in which planets not only create life, but life, by the same token, creates planets.

A pioneer in this regard was the Ukrainian mineralogist Vladimir Vernadsky. As a young man, Vernadsky read an eye-witness account, published in 'Nature' journal, of a swarm of locusts spotted travelling above the Red Sea. The Nature article estimated the swarm to contain 24 quadrillion organisms & weigh some 43 billion tonnes. Which was off by one order of magnitude, but still a big swarm. Considering the swarm, Vernadsky realised that the swarm was best thought of, in his words: "in terms of chemical elements & metric tons, [as] analogical to a rock formation; or, more precisely, to a moving rock formation endowed with free energy." This triggered in Vernadsky a lifelong determination to reveal the ways in which life, properly considered, is a geophysical, terraforming force

Inspired by Koene's earlier intimations, Vernadsky became the first to robustly argue for the much of the matter in Earth's atmosphere and geosphere is biogenic in origin, that is created by life. In his 1926 masterwork, *Biosphere*, Vernadsky popularised the titular term, whilst detailing the ways in which life is a colossal agent of planetary change: primarily, by accelerating the rates of transformation of all kinds of matter & energy. However, during World War 1, Vernadsky became additionally convinced that, just as the emergence of life radically reorganised the geosphere, the emergence of human cognition is set to fundamentally reorganise the biosphere. He saw the Great War and its release of massive energies as, in his words: "a geological, and not just a historical, event." And in the background is a trench from Verdun that is still visible from above.

Accordingly, borrowing a term developed independently by the French palaeontologist Pierre Teilhard de Chardin, Vernadsky announced the inauguration of a new "layer" to the Earth system, one dictated by the actions of thinking life. He called this the "noosphere". Vernadsky wrote: "Humanity, taken as a whole, is becoming a powerful geological force. [...] This new state of the biosphere, to which we are approaching without noticing it, is the 'noosphere'." [This] is a new geological phenomenon on our planet. In it, for the first time, man becomes the largest geological force."

Contrarily, de Chardin spoke of the "noosphere" as Earth's "thinking superstratum". He pronounced that—in the form of civilisation's intensifying flows of information & energy—the Earth itself was, by analogy to the centralisation of a nervous system, developing its own brain. De Chardin argued our planet was becoming "cephalised" or "ensouled"; that is, gestating its own planetary cogito.

A Jesuit mystic, Teilhard was convinced this centration of "thinking energy" on the surface of the world would eventually produce a manifestation of divinity itself. He called this the "Point Omega"; the inevitable, crowning endpoint of the entire upsurge of cosmic evolution, implicit from the birth of the first atom. In other words, de Chardin was not sensitive to catastrophes which might derail this culmination, from within or without. In this, de Chardin was shockingly explicit. He wrote in 1935: "There are so many ways to come to an end! Microbial invasions. Organic counter-evolutions. Sterility. War. [...] And yet by basing myself on everything the past of evolution teaches us, I believe I can say that the degree to which any of these multiple disasters imply [...] premature accident or decline, we have nothing to fear from them. Although possible in theory, for a higher reason, we can be sure they will not happen." Again, recent revelations, regarding the resilience of the biosphere over a deepening geological past, caused many, Teilhard included, to induce forwards to an equally secure future.

By contrast to de Chardin's spiritualism, Vernadsky was far more materialistic in his analysis. Pointing to the increasing weight of "artificial chemical compounds" in the Earth system, alongside the ways in which humanity, in his words, creates "new species [of] animals & plants", Vernadsky announced: "The face of the planet [is] chemically dramatically changed by humankind, consciously & mainly unconsciously."

Nonetheless, Vernadsky, too, ultimately rejected any existential threats to the infant noosphere. Looking back on his career in the mid-1940s, he couldn't dismiss the fact that the fledgling "thinking superstratum" had descended into a yet more destructive spasm of war. Vernadsky wrote in 1943: "We are entering into [the noosphere] in a terrible time, in the era of a destructive world war."

As early as the 1920s, Vernadsky had anticipated the destructive potentials of nuclear energy. Presciently, in untranslated essays, he foresaw that, in his words, that: "We are approaching a great turning point in the life of humanity, which cannot be compared with all that [came] before. It is not far off the time when humans will obtain atomic energy [...] Will our species be able to use this power [...] for good rather than self-destruction?"

So, writing from 1943, on the brink of the deployment of such forces—near the crescendo of history's worst conflagration—did our Seer of the Noosphere entertain the possibility of anthropogenic global catastrophe? He didn't. Again, based on inductive confidence given unbroken "progress" throughout Earth's evolutionary past. He explained. In 1944 he wrote: "Currently, given the surrounding horrors of life, along with the unprecedented flowering of scientific thought, we hear of [the] collapse of

civilisation & the self-destruction of humanity. It seems to me these moods [are] the result of an insufficiently deep penetration into our wider situation. [...] Scientific knowledge, manifested as a geological force that creates the noosphere, cannot lead to results that contradict the geological process of which it is the creation. This is not a contingent phenomenon—its roots are extremely deep...”

Vernadsky saw his noosphere as predetermined from Earth’s very origins; accordingly, he was unwilling to entertain its existential precarity. Elsewhere, in his letters, he concluded firmly: “[The noosphere’s] formation was inevitable [...]. It was prepared by hundreds of thousands of generations & cannot be changed by the ‘accidents’ of human history—by individuals or trends...”

All in all, such a view precludes entertaining the possibility that a technological civilisation, by altering its planetary climate, may be able to undermine its own conditions of existence.

## PART 10: FAREWELL FANTASTIC VENUS!

53:10

Part 10: Farewell Fantastic Venus!

This is when some of that confidence starts to get pulled apart. This confidence was reflected, again, in persisting assumptions about the inevitability of complex life throughout the cosmos. Vernadsky, & many other mid-century scientists, maintained that the other rocky planets in our Solar System are probably inhabited. In 1944, he wrote: “[...life] exists not on our planet alone. This has been established [...] without a doubt for all the so-called ‘terrestrial planets’, that is, for Venus [&] Mars.”

In this, Vernadsky was far from alone. In 1950, a man named Arthur sent a letter to Hayden Planetarium in New York, putting himself forward as an applicant “for a space trip to Venus”. He was desperate to go, he explained, because he wanted to find out if “there are really dinosaurs living on it.”

This, surprisingly, was a common belief, persisting well into the mid-20th century. For decades, astronomers had observed our planetary neighbour has a thick, swirling atmosphere. Aside from its similar size, this is why Venus is often called Earth’s twin. Highly reflective, making the Morning Star so bright, these clouds completely obscure the Venusian surface. Venus’s shrouds, therefore, allowed it to become a blank slate onto which wishful fantasies could be projected. Again, by this point, there was unanimous understanding that planets have histories—that they are born, they age, & they die—but there was not yet much appreciation they can have very different histories. The assumption remained that they embody ‘earlier’ & ‘later’ versions of one, identical evolutionary arc.

Hence, again, Venus was thought to be going through something identical to Earth’s own Carboniferous. Many popular science articles seriously entertained this hypothesis throughout the first half of the 20th century. You can see an illustration of a Venusian dragon. This is from an article in Popular Science Monthly in 1924.

So, people believed there were dinosaurs on Venus. And again, you see big game hunting on Venus and a triceratops. This is from the 40s. This is why our sister planet thus became a well-worn destination for early-1900s science fiction. Again, you can see the text here saying that Venus will seem like a prehistoric world.

However, all of this was toppled one fateful day in December, 1962. On this day, NASA’s Mariner II probe streaked within 35,000km of Venus. Spurred by the Space Race, this was humanity’s first successful flyby of another planet; it revealed our twin was neither balmy nor tropical. Far from it: Venus’s surface, it turned out, is scorched by hellish heat. In October 1967, when the Soviet’s Venera IV probe became the first mission to enter the Venusian atmosphere, it further confirmed that “Venus is hell”. Not only is its surface hot enough to melt lead, it is also fearsomely pressurised.

Mournfully, the sci-fi authors had to say farewell to their fantastic Venus. This is a collection edited by Brian Aldous, which has a very mournful tone throughout, in 1968 it was published. Soon, however, it was realised our twin wasn’t always so inhospitable. In the Solar System’s early days, Venus was probably quite clement, oceanic, even habitable. But, then, something happened to trigger its hellish transformation.

Following the Venera probe’s 1967 revelations, planetary scientist Andrew Ingersoll became the first to provide a detailed model for what we now call the “runaway greenhouse”. This describes a process whereby an increase in temperature causes water to evaporate, which in turn causes greater atmospheric heat retention, triggering temperatures to continue rising in a self-reinforcing loop. This way, the shock-revelation: our sister planet is a pressure-cooked hellscape proved that planetary histories don’t everywhere unfold according to the same predetermined script. Instead, their stories can be veered, catastrophically, in wildly divergent directions, in ways apparently not dictated by destiny.

Naturally, it also hinted to the ways in which our planet’s own climactic future may hang in the balance, hinging on human actions today. Through being forced to say farewell to fantastic Venus, we discovered potentials for climate doom down here on Earth. Accordingly, from 1970 onward, prominent scientists from Carl Sagan to Isaac

Asimov to Thomas Donahue here began arguing, as Donahue put it: “our studies of Venus opened up the possibilities of a runaway on earth. [...] We don’t know what the runaway point is. But it’s at least conceivable that if we burn enough coal & oil, we’ll get to it.”

In tandem with developments in computer modelling, this lent urgency to the maturing field of climate science, which itself would lead to today’s consensus around the reality of anthropogenic climate change.

More recent studies imply that fossil fuel emissions likely couldn’t produce a ‘run-away greenhouse’ on Earth. However, Venus’s fate nonetheless provoked deeper appreciation of the sensitivity of planetary atmospheres, whilst also thereby imparting impetus to investigations into the worst-case, most catastrophic outcomes possible here on planet Earth.

## PART 11: DISTURBING THE UNIVERSE

59:39

Part 11: Disturbing The Universe

Now, here’s where things actually get interesting. We’re also getting towards the end, so don’t worry. I told you that the planetary scale was a small scale, so. As the probes relayed data from Mars & Venus throughout the 1960s, it became obvious that Earth was, after all, the only inhabited planet in our Solar System &, undoubtedly, the sole celestial body in that System to have produced anything “Psychozoic”. But what of elsewhere? What of other stars?

In 1961, efforts began in earnest to answer this question: to search our galaxy & see if it was bustling with other intelligent planets, as many have long assumed it would be. Using radio astronomy, the Search for Extraterrestrial Intelligence (SETI), with and “S” not “C,” was launched to scour the night skies for “psychozoic” babble. Initially expecting to tune into a cacophonous universe the astronomers found nothing. Only silence. No sign of mind has been found since; not one trace. The cosmos, it turns out, is a quiet place.

Quickly, critics pointed out the anthropomorphism of all this. After all, only one species on Earth sends & receives radio signals. Had we come much farther than Victorian assumptions that all evolution must tend inexorably “headward”?

In response, a more sophisticated form of SETI was proposed: one searching not for markers left by only one terrestrial species, but, instead, for markers left by all life: that is, the tendency to disturb & transform its environment. After all, all life presupposes metabolism: the transformations of energy & their byproducts.

Once again, the oxygen we are breathing is the fossil of the ancient industrialism of the first photosynthesiers. Moreover, all life, ultimately, feeds on its sun: whether directly, through photosynthesis; or indirectly, through food chains. So, it was asked: what kind of metabolic activity might be visible across the sidereal void?

Harking back to a conjecture first posed in 1960 by British physicist Freeman Dyson, Soviet & American scientists began arguing that we should be searching the skies for feats of “astroengineering”. This would be evidence of stars, whose vast outpouring of energy, rather than being squandered by being pumped into space’s void, is somehow being sapped, to sustain the metabolism of some extremely formidable form of organised life. Dyson had suggested vast shells of solar panels surrounding stars. These, of course, as you all know, came to be known as “Dyson spheres”.

However, not to be upstaged by a Brit, the Soviets came up with their own more versatile design in 1973. The “Pokrovsky shell”, which has a kind of folding design, so you can turn on and off bits of sucking up the solar energy. So, just as plants ‘farm’ sunlight, such a structure would essentially be a photosynthesising superorganism: a stellivore, or “star-eater”.

Through the 1960s & 70s, Nikolai Kardashev extended this line of thought, posing an ascending scale of environmental “psychozoicization” at planetary, stellar, galactic, &, even eventually, cosmic scales. This approach, called “Dysonian SETI”, has the benefit of jettisoning the anthropocentric baggage involved in looking for intentional extraterrestrial communications. Because, instead, it looks only for the unintentional footprints of life. That is, life’s tendency to transform its environment via rerouting preexisting energy flows for metabolic ends.

Thus, just as terrestrial life has intensified its energy throughput on the path from single cell to civilisational superorganism, & just as it has increasingly transformed its planetary environment as a result, so too might more formidable forms of life, originating elsewhere, be disturbing their surroundings at far greater—thus perhaps cosmically visible—scales. And so, have we spotted any “stellivores”? The answer, of course, is no.

Many have argued that, given the sheer size of the observable universe, if such feats were minimally possible, they should be detectable at least somewhere. But the galaxies appear unanimously “azoic”, or lacking life. Enter the peerless Polish polymath, Stanisław Lem, the hero of many talks throughout Antikythera, I think. Across his career, Lem continually pondered this cosmic silence, or, the fact that our universe



appears to be, in Lem's terms: "a psychozoic vacuum." Through fiction & philosophy, Lem offered many intriguing solutions to this paradox. His most striking, however, consisted in jettisoning one assumption common to all previous lines of reasoning that is, that as intelligence develops, & deepens its ability to manipulate nature, its tendency to perturb & disturb its environment will also keep increasing.

Empirically, on Earth, we've witnessed these tendencies tightly coupled, particularly since the Industrial Revolution. But what's been true on Earth, for the past handful of centuries, need not be true everywhere & everywhen. As Lem put it: "The Intelligence we shall discover one day will possibly be so different from our ideas of it we shall not even want to call it Intelligence [...] It does not look like intelligent activity to us because man favours a heroic attack on the surrounding matter. But this is just a sign of our anthropocentrism."

Indeed, the assumption that, as technology becomes more powerful, its manifestations will become more distinct from surrounding nature is entirely based on our limited, anthropocentric experience. That is, of the past 300 years of accelerating environmental disruption on Earth.

But could it not be that, past a certain point of aptitude, more capable technologies actually begin to reverse this trend & instead start collapsing this previously widening distinction between 'the artificial' & 'the natural'? After all, would it not be more elegant—not to mention efficient & sustainable—to work with & through nature's preexisting complexities, rather than against them in an "heroic attack"? If we look to today's technoscience's frontiers, from protein engineering to biocomputing, to intelligent organoids, this seems to indeed be the case: where, instead of tearing them up, intelligent artifice becomes literally woven into preexisting natural systems. No longer parasitically replacing nature, artifice now tends toward the creation of entirely new ones.

Accordingly, Lem extrapolated from this, speculating that the most potent forms of intelligence eventually become indistinguishable from their surroundings because, in a sense, they become their surroundings.

As such, Lem arrived at his mind-bending conclusion in an essay written in 1971 called the 'New Cosmogony'. He wrote: "If one considered 'artificial' to be what is shaped by an active Intelligence, then the entire Universe that surrounds us [may be] already artificial [...] Instrumental technologies are required only by a civilisation still in an embryonic stage, like Earth's. A billion-year-old civilisation employs none. Its tools are what we call the Laws of Nature. Physics itself is the 'machine' of such civilisations!"

It is thus at least plausible, Lem provoked, that we live in a universe where full-scale "psychozoicization" has already taken place. In other words, we might be living inside the artefact of ancient precursors.

Which takes us back to the beginning. Perhaps, earlier generations were correct, when they proclaimed that, as Alexander Pope wrote in 1733: "All nature is but art unknown to thee." Which is obviously absurd.

However, Lem articulates a serious point here: although they remain indispensable to our definitions of what intelligence is, we ought to remain thoughtfully cautious of distinctions between what's 'natural' & 'artificial', as the boundaries between them are fragile, & liable to break down when stressed.

## PART 12: CONCLUSION

1:09:56

Part 12: Conclusion

To bring things back to earth, some concluding thoughts. In our current moment of climate breakdown, it can be easy to dismiss technology itself as inherently, irredeemably fallen: to feel human interventions are only ever capable of damaging the world; to, thus, condemn all things 'artificial'. But this is to miss something crucial. The mere fact that we are aware of our effects on the climate is a colossal achievement, the extent of which is only put into relief by retracing the vast pile of errors from which current consensus was necessarily forged.

Though other species have perturbed the biosphere, we are the only species that has ever become aware of it. Such awareness, moreover, had to be earned. It was necessary that it took time—and some serious conceptual misadventures—for our kind to begin figuring out where the present moment precariously stands in deepest time. Let's just be thankful that some of the fallacious proposals from the past, from draining the ocean to burning all the coal seams in-site, weren't taken more seriously.

None of this, of course, is any excuse for self-satisfaction; but a summons to urgent action. For the ability to have corrected such colossal error in the past implies at least the potential to overcome challenges of similar proportion in the future & ought, of course, implies can. Indeed, it might today seem an impossible challenge to forge a technosphere that enters into a symbiotic—rather than parasitic—relationship with the biosphere which birthed it. But so too did accurately dating our Earth seem impossible only several generations ago.

So, to conclude: We live in a moment of climate breakdown. But this doesn't mean there is no hope that we still live in the prehistory to true planetary intelligence. Nor is it grounds to dismiss all suggestion our descendants may one day inaugurate an epoch worthy of the name "Psychozoic". Because, preparatory to the age of planetary sapience, there will, of course, need to have been a good few episodes of planetary errancy. Every bildungsroman, after all, requires its episodes of error and even its detours of vast stupidity. Thank you.