

Clima(c)tic Change: Twenty Million Hands and the Living, Wavering Globe

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Last August, I heard an NPR discussion¹ of climate change in relation to the Inflation Reduction Act, a bill designating almost \$800 billion to energy security and climate change. The show's host emphasized that, per the UN's Intergovernmental Panel on Climate Change (the IPCC), fossil fuel usage must fall dramatically within ten years to keep Earth's warming by 2100 below 1.5°C.² She asked the Director of the Bureau of Land Management, Tracy Stone-Manning, "Is this process that we're currently following going to get us there?" To my astonishment, Ms. Stone-Manning replied, "Yes. Yes is the answer." The unequivocal answer was surprising given the BLM's equivocal charge: as manager of federal lands, one of its responsibilities is to award oil and gas leases.³ So, somehow, partly as a result of the Inflation Reduction Act, we will as a nation, albeit a politically divided one, meet requirements to limit warming to 1.5°C while still doling out oil and gas leases and without asking our citizenry to make substantive behavioral changes.

Ms. Stone-Manning's response reminded me of the 2015 Paris Climate Accords, which the United States initially joined, before withdrawing under President Trump and re-joining under President

¹ The show was "1A," hosted by Jenn White. It aired on August 12, 2023.

² What Ms. White actually said is this: "The United Nations Intergovernmental Panel on Climate Change has repeatedly said that the world has to phase out fossil fuels quickly to keep earth's warming below 1.5 °C increase, which we are currently not on track to do... Time is of the essence. We have a limited amount of time – again by 2035, the UN Intergovernmental Panel says we have to phase out fossil fuels to keep the earth's warming below that 1.5 °C increase." Per the IPCC 6th assessment report, fossil fuel emissions need to be reduced 50% by 2030 and 100% by 2050 to limit warming to 1.5 °C by 2100. Ms. White's imprecision is symptomatic of a broader problem: the implication that fossil fuels have to be entirely phased out by 2035 can only signify how little she has imagined the difficulty of merely reducing them by half in that time period. And, by the way, what happens after 2100?

³ An even more egregious example of such ambivalence (the word is mild) is how the United Arab Emirates, host of the 2023 United Nations Climate Change Conference (COP28), planned, per a BBC review of leaked documents, to use that conference to pursue oil and gas deals with foreign governments. But is this really surprising when the President of the COP28 happens also to be the CEO of the UAE's giant state oil company?

Biden. These Accords set as their upper target 2°C of warming by 2100 and their ideal target as 1.5°C. The latter requires a 50% cut in global greenhouse gas emissions by 2030. What distressed me about the Accords, however, was that the agreed-upon means in no conceivable way could meet that goal. The modeling studies grounding the Accords clearly showed that. In fact, annual global greenhouse gas emissions are higher now than they were in 2015.⁴ The Accords set 2030 as their deadline for a 50% cut; over half of that time has elapsed; and we are further from that goal now than when we started (slide).⁵

Fundamental reasons explain why we've made so little progress cutting greenhouse gases, reasons which we haven't seriously confronted politically or socially. We may think, for example, that electric cars will save us; we even call them, falsely, "emissions-free vehicles." This falsehood epitomizes the problem. We are too comfortable imagining vehicles have no emissions if we see no tail pipes. We forget that the missing tail pipe is actually a power plant's smokestack. Such forgetfulness is encouraged by those who understand that part of what they're selling is a clean conscience, moreover one which allows us to get on with our lives without substantively changing them.

Even if we correct this forgetfulness, we too comfortably believe the gases causing climate change are mostly the consequence of vehicles and residences; hence the solution is electric cars and solar panels. Globally, however, ground transportation and residential sources account for only a third of

⁴ There's discrepancy among reported global greenhouse gas emissions, in part depending on whether only CO₂ is considered or CO₂ plus other gasses and actions (which collectively are called "CO₂ equivalents [CO₂e]"). In terms of CO₂, 2022 estimates range from 36.1 (Liu, Deng, Davis and Ciais [2023] *Nature Reviews Earth and Environment* 4: 205 – 6) to 36.8 Gt CO₂ (the International Energy Agency's 2022 report, "CO₂ emissions in 2022"). Preliminary 2023 data suggest CO₂ increased another 1.1% from 2022 (<https://globalcarbonbudget.org/fossil-co2-emissions-at-record-high-in-2023/>). As for CO₂e, the UN's emissions gap report (<https://doi.org/10.59117/20.500.11822/43922>) gives a 2022 value of 57.4 Gt. Whether measuring CO₂ or CO₂e, these reports agree that the corresponding 2015 value was lower (e.g., 35.6 Gt CO₂ or 47 Gt CO₂e). Differences in estimates may also reflect treatment of natural but extraordinary emissions, as from forest fires. For example, the 2023 Canadian forest fires collectively burned an area the size of Washington state and produced ~3 times the CO₂ emitted annually by all of Canada, but some approaches would omit these sources as extraordinary and natural. Yet it is foreseeable that such sources will soon become ordinary, and whether a source is "natural" or not will have no effect on how much the planet warms.

⁵ Put otherwise, it's estimated that we can afford to add a cumulative total of about 250 Gt of carbon dioxide to the atmosphere to give ourselves a 50% chance of keeping warming below 1.5 °C; we're currently on pace to emit that much carbon dioxide within ~ 7 years. Lamboll et al. (2023) Assessing the size and uncertainty of remaining carbon budgets. *Nature Climate Change*. <https://doi.org/10.1038/s41558-023-01848-5>.

annual anthropogenic CO₂ emissions. Our fossil-fuel dependence goes well beyond vehicles and homes.⁶ In particular let me call attention to four material mainstays of modern civilization which are fossil-fuel intensive: plastic, steel, concrete and ammonia fertilizers. Collectively they require ~20% of the world's primary energy supply and generate at least 25% of anthropogenic CO₂ emissions.⁷ Consider all the plastic you handle every day. Consider the steel and plastic required for even an electric car. Consider the steel, plastic and concrete needed for solar-panel installation and building construction, including LEED-certified green buildings. Consider projections that plastic production will double by 2045 (**slide**) and the world's building stock by 2060. That latter is equivalent to building a new New York City every month of every year between now and then.⁸ Consider the immense quantities of fertilizer needed to sustain 8 billion people and their animals.⁹ Consider how energy-intensive food production in the western world is, where every calorie of food requires about a dozen calories of fossil fuels, and where in the United States, 30-40% of that food is thrown away.¹⁰ *Consider, in short, how fossil-fuel intensive a transition to a green economy will necessarily be.*

Now ask yourself: what dream are we dreaming, which says we can go green without really changing? That message is loudly proclaimed by many on the left: "Let's have a green revolution," they say, "so we don't have to change!" Can there be revolution without profound change? Many on the left say, make fairly minor changes so you don't really have to change. Many on the right say, it's all an exaggeration or a hoax, change isn't needed; if anything, we should change back. Instead of focusing on the disagreement between right and left, notice their substantive agreement. The difference is between

⁶ The children's book Petro Pete's Big Bad Dream describes some of the dramatic changes in our everyday lives should fossil fuels abruptly disappear or not be used. It has been widely criticized as Big Oil's attempt to brainwash kids. This criticism is undoubtedly true – but that doesn't make the cascading effects of our fossil-fuel dependence, to which the story calls attention, untrue. To conclude the latter from the former is its own kind of brainwashing.

⁷ Smil, How the World Really Works, p. 78.

⁸ The NYC analogue is from Reilly O'Hara around the 10-minute mark in Peter O'Dowd's "A 'concrete' solution to climate change": <https://www.wbur.org/hereandnow/2023/12/07/concrete-climate-change-solution>.

⁹ ~15% of all human-caused greenhouse gas emissions are due to livestock farming, to satisfy our desire for meat.

¹⁰ For the dozen calories claim, see Ghosh (2016), The Great Derangement, p. 147. 30-40% is the USDA's estimate.

not changing and changing very little.¹¹

Should we take seriously that climate change is an exaggeration, a hoax, mere, self-interested alarmism? On the one hand, of course we should. The computer models which divide the earth into enormous numbers of grid squares and try to calculate the consequences of every significant biological, chemical and physical process in each square are beyond the critical ken of a human mind. A projection 100 years into the future requires a million billion calculations (**slide**). Many are simply parameterizations of phenomena we don't understand. The interdisciplinarity upon which climate research rests is also often authority-driven – collaborative in the mode of deference more than of criticism. Major incentives to jump on the climate-change bandwagon exist, including career and funding incentives. We'd be naïve to imagine all that away, as, even more importantly, we'd be naïve not to wonder about the competence which synthesizes so much specialized knowledge, assuming we can tell what is and isn't knowledge.

On the other hand, warranted skepticism does not deliver us to the *knowledge* that it's all a hoax. Far from it. We've had warnings, growing in clarity and urgency, since a pioneering paper by Arrhenius in 1896.¹² In 1938, Callendar calculated that the planet had warmed ~0.25°C over the previous half-century due to CO₂ production by fuel combustion. He then developed a basic model which predicted that around 420 ppm atmospheric CO₂ we should expect ~1°C of warming relative to 1938 (**slide**).¹³ We are now around 420 ppm CO₂ and we've had ~1°C of warming relative to 1938. Since then models have become more complicated and refined, offering high-resolution predictions of what global temperature increases mean at regional scales; they've added ocean and atmospheric circulation and positive and negative feedbacks; they've incorporated responses of the living world; they've even

¹¹ Right and left often arrive at opposite conclusions from the same premise, or, as in this case, (basically) the same conclusion from opposite premises. Such phenomena are marks that something other than thinking is happening.

¹² Arrhenius' Swedish colleague, the mostly forgotten Arvid Högbom, actually called attention to the problem in 1894, which in part stimulated Arrhenius to examine it more carefully in his theoretical 1896 paper. By 1904, Arrhenius concluded that the planet would warm due to human activities, though probably in a beneficial way.

¹³ See Callendar (1938) *Quarterly Journal of the Royal Meteorological Society* 64: 223 – 40, particularly Fig. 2.

charted possible social and political responses. But the problem's basic contours, the relation of greenhouse gases from fossil fuel combustion to planetary warming and the consequent dangers, have been reasonably well understood for decades. To some degree we've allowed ourselves to be distracted by seeking ever-greater refinements of the simulacra by which we make this problem visible, as if simulacra could stand in for the world where that problem must be addressed and as if the indefinite pursuit of knowledge weren't itself a deferral of behavioral change.

Accepting then that climate change is real, how alarmed should we be? After all, the world has had higher CO₂ concentrations than now. The last time the planet had comparable CO₂ concentrations was 4.3 million years ago in the mid-Pliocene; the planet was about 3°C warmer than now. That may not sound like a lot, given diurnal temperature changes in New Mexico of ~15°C and seasonal ones of ~20. But those 3°C corresponded to a planet many would find unfamiliar, with sea levels 75 feet higher than today, Florida a mere nub and southeastern Mexico under water (**slide**). Our nearest relative 4 million years ago was *Australopithecus*; it would be another million years before the genus *Homo* appeared. Obviously, there weren't 8 billion people on earth. Human civilization 4.3 million years ago was still roughly 4.3 million years in the future – a reminder that civilization is young.

Besides different atmospheric CO₂ concentrations, earth has also had dramatically different past temperature regimes. It has been much colder – I'm not talking Pleistocene ice ages, but something more extreme – Snowball Earth episodes 600 to 700 million years ago when the planet was close to globally glaciated (**slide**). The planet has also been much warmer, including during the Cretaceous hothouse 110 million years ago and, 56 million years ago, the Paleocene-Eocene Thermal Maximum, when the poles were ice-free and alligators swam in an Arctic lined by palm trees.

If it comforts you to know the planet can handle much colder and warmer temperatures, if you think that means there's nothing to worry about, consider rates of change.¹⁴ During the Cretaceous

¹⁴ The rates which follow are from Kump (2011) *Scientific American* July: 56 – 61.

hothouse, the planet warmed about 0.000025°C per century, for a total warming of 5°C over millions of years. During the Paleocene-Eocene Thermal Maximum, the rate of warming was a thousand times faster: 0.025°C per hundred years, again for a total warming of 5°C over tens of thousands of years – a warming coincident with an extinction event.¹⁵ In contrast, we've already warmed about 1°C in the last century, with future warming projected at as much as 5.7°C by 2100, depending on what we do (slide). That 5.7°C , equivalent to the warming which occurred over millions of years during the Cretaceous hothouse and tens of thousands of years during the Paleocene-Eocene Thermal Maximum, is according to the IPCC's least optimistic emissions scenario, but that scenario is the one which most accurately matches actual cumulative emissions since 2005, predicting them within 1%.¹⁶ The, to-my-eye unrealistic, goal of the Paris Climate Accords is to limit warming to a mere 1.5-to- 2°C this century. We're banking on that, with most of us not realizing how dramatic a rate of planetary warming that actually is, to say nothing of what may happen after 2100.¹⁷

These numbers make even more sense from another angle: it took hundreds of millions of years to accumulate fossil fuel reserves which we've injected into the atmosphere over a few centuries (and most in one century). In terms of biogeochemical cycles, that's a discrepancy in rates of six orders of magnitude. In short, the rate of planetary perturbation is extraordinary, especially in the context of the

¹⁵ It's not surprisingly unclear whether or how the extinction event (which was marine) and the warming are linked. Another dramatic change in planetary temperature occurred during the Eocene-Oligocene Transition between 33.9 and 33.4 million years ago, when the planet cooled as much as 0.01°C per century (*Paleoceanography* 11(3): 251-66, 1996). This also coincided with a significant terrestrial and marine extinction event.

¹⁶ Schwalm, Glendon and Duffy (2020) RCP8.5 tracks cumulative CO2 emissions. *PNAS* 117 (33): 19656 – 7.

¹⁷ The Dansgaard-Oeschger (D-O) events during the last glacial period are the closest analogues to our current situation of which I'm aware, in terms of scale and rate of warming. Ice-core evidence suggests that, around 11,500 years ago, the Greenland ice sheet warmed $\sim 8^{\circ}\text{C}$ in about half a century. How this extreme warming event in Greenland corresponded to the planet as a whole is uncertain; contemporaneous ice cores from Antarctica show less and slower warming. If we assume nonetheless that the warming was global in extent, we can do a back-of-the-envelope comparison as follows: since the Arctic is currently warming ~ 4 times faster than the global average, an 8-degree warming over Greenland in 50 years is roughly comparable to ~ 4 degrees of present-day global warming in a century – well within what's possible per current projections. The warming 11,500 years ago was short-lived, however (half a century, followed by centuries of slower cooling) in contrast to present expectations, which anticipate up to 5.7°C by 2100 and quite possibly further warming thereafter.

relative stability of climate which has pertained for most of the period civilization has flourished.¹⁸ That rate of change is a more threatening aspect of climate change than the fact of warming. We are not just facing a world of enhanced drought and intensified storms, where the Great Salt Lake becomes an empty basin and metropolises drain dry the aquifers on which they rely and rest,¹⁹ while sea levels gradually rise and forest fires rage. We are facing a world which is fundamentally and rapidly reorganizing; where the last calendar year, 2023, was possibly the hottest in the last 100,000 years but likely won't hold that record for long;²⁰ where, in most of our lifetimes, the Arctic's radiation-reflecting, heat-reducing toupee of sea ice, whose maximum extent twenty years ago was 14 million square kilometers, will disappear seasonally;²¹ and where, partly as a consequence of the melting sea ice, a major conveyor of heat on the planet, the Atlantic Meridional Overturning Circulation, will dramatically weaken or even shut down,²² fundamentally changing the distribution of heat on earth (**slide**).

This will matter not just to us but to innumerable organisms who, like us, depend on fairly predictable patterns which already are becoming unreliable. It's not clear that most organisms and ecosystems can respond fast enough. In the Pleistocene ice ages a primary response was migration – moving north and south and up and down mountains as ice advanced and retreated. But those

¹⁸ Indeed, abrupt civilization collapses, as occurred nearly synchronously with the Akkadian (Sargonic) empire, the Egyptian Old Kingdom and possibly the Indus Valley civilization, are strongly correlated with abrupt climatic shifts (e.g., Weiss et al. [1993] *Science* 261: 995 – 1004).

¹⁹ Per a recent study of ~ 75% of global groundwater withdrawals, aquifer declines have accelerated dramatically in the last 40 years for a third of all regional aquifers, while groundwater declines > 0.5 m/year are widespread (Jasechko et al [2024] *Nature* 625: 715 -21). Major metropolises, such as Tehran (population 13 million) and Mexico City (22 million), are seeing subsidence rates of up to 50 cm/year due to groundwater depletion, with projections that large sections of Mexico City will be without reliable water within months (which pertains already to some parts of the city; Paddison et al., 2/25/24, "One of the world's biggest cities may be months away from running out of water," CNN). Subsidence due largely to water withdrawal is also being measured not in inches but in feet in parts of California's Central Valley (Dan Charles, *All things considered* [NPR], 7/23/21), source of over half of all nuts, fruits and vegetables grown in the US. Subsidence poses obvious risks to infrastructure, but even these risks are dwarfed by the impending, local exhaustion of freshwater in large parts of the world.

²⁰ Schmidt (2024) *Nature* 627: 467.

²¹ When I started graduate school in 1999, a seasonally ice-free Arctic was predicted for around 2100. When I finished graduate school in 2006, a small number of studies suggested it could happen by 2050. Now it's looking increasingly likely that it could happen in the 2030's: e.g., Kim et al. (2023) *Nature Communications* 14: 3139.

²² Zhu et al. (2023) *Nature Communications* 14: 1245; van Westen et al. (2024) *Sci. Adv.* 10, eadk1189.

migrations typically occurred over longer timescales than we face, and, perhaps even more importantly, on a planet much less fragmented by human-created barriers.²³ We are currently in the midst of the 7th mass extinction event²⁴ in earth's metazoan history, with extinction rates a thousand times greater than background. We should worry, how much worse will it get?²⁵ In lieu of imagining all species as rugged individuals with independent fates, we should also worry about how interconnected the ecological world is and how linked many of our fates may be.

So here we are, faced with an ongoing mass extinction event and dramatic rates of planetary change. What are we doing? We are persisting in the dream that we can carry on more or less as we imagine we always have, that necessary changes are only on the fringes. Indeed, the Inflation Reduction Act sets aside \$161 million to restore landscapes to historic conditions, because, according to the BLM Director, "a restored landscape is more naturally in balance... [T]hat natural cycle that has been with us for the millennia, that's what we need to strive to restore..."²⁶ Setting aside the question of whether nature has ever really been in balance, setting aside as well the question of what we mean by nature (slide), we still should confront the smaller question – why are we trying to restore natural cycles of past millennia in a dramatically changed and changing world? I see groups dedicated to eradicating alien species. I hear in the ecological register a disturbing echo of a terrifying political project. It really worries me. But I also don't understand what our thinking is, to eradicate immigrant species when the scale of

²³ One political response to challenges partly due to climate change has been to reify borders – to build walls – and not just in the US (e.g., Poland's 185-km wall on its border with Belarus; Hungary's 320-km wall separating it from Serbia and Croatia; Lithuania's 480-km wall, also on its border with Belarus; Finland's proposed 1300-km wall on its Russian border; and India's ongoing efforts to wall 75% of its 4000 km border with Bangladesh.) The Akkadian empire did the same thing, building a 180-km wall to repel migrants, in its failed effort to stave off its own climate-change-associated collapse in the early bronze age. Walls will be catastrophic not only for humans but other animals. Moreover, walls will wall in as well as wall out; in a changing world a wall will inevitably be two-edged.

²⁴ Accepting the Capitanian as a mass extinction event in the mid-Permian.

²⁵ Even seemingly small changes in planetary heat can have surprising consequences. A marine heat-wave of between +0.5 and +3°C in the bottom waters of the eastern Bering Sea in 2018-19 is thought to have led to the deaths of >10 billion snow crab – not because they couldn't endure the heat, but because the higher temperatures enhanced their metabolic requirements, leading to famine and cannibalism. A water temperature change from 0°C to 3°C can double a crab's caloric requirements in the laboratory. See Szuwalski et al. (2023) *Science* 308: 306-310.

²⁶ As quoted in the NPR interview cited earlier.

planetary change likely can be met for many organisms, probably including humans, only by massive migration – and I wonder, what is it exactly that we’re trying to preserve, and why? Is this another manifestation of how we want to have a revolution without changing, of how we want, as it were, to spin our wheels?

I observed earlier that civilization is young. In roughly 10,000 years, we’ve gone from Neolithic clusters to New York City, while the global human population has exploded (**slide**). When Socrates lived, the world probably hosted about 100 million people, roughly the same number as now live in just three cities: Tokyo, Jakarta and Delhi. It took all of human history to reach a billion people around 1800; and another century-plus to reach 2 billion when my grandmother was born. When my mother was born, 2.5 billion people lived on earth. When my sister was born 25 years later, there were 4 billion. In 2022 we hit 8 billion, with 11 billion expected by 2100. Let me state the obvious: this enormous growth has occurred in nearly exact conjunction with our intensive utilization of fossil fuels.²⁷ This should impress upon us our extreme dependence on fossil fuels, even while we imagine we can painlessly switch to new energy sources without substantively changing our lives. In fact, per the Inflation Reduction Act, we plan to restore natural cycles to patterns from the last millennia, as if the dramatic transformation of earth by human activities over those same millennia doesn’t really count.

If we wish to be serious about climate change, we must do much more. We must let go of many familiar things. We must understand that restoration is mostly off-the-table, or else is a nostalgic aesthetic illusion. We must stop pretending we can achieve a transformation without parallel in human history on the back of only minor inconveniences.

Two paths stretch before us (**slide**). One relies almost exclusively on technology, whether existent technology yet to be built to scale, or technology that doesn’t even exist, in the hopes that it will deliver us from having to make substantive changes (as if technology itself weren’t a substantive change)

²⁷ Likewise, India’s and China’s rise as global powers is not coincidentally linked to their intensive use of fossil fuels.

– and, further, in the hopes that it doesn’t have unforeseen consequences, though history is rife with those consequences – not least of which is climate change. I call this path the path of techno-theology. Rather than praying to the storm god to have mercy on us, we will pray to AI.²⁸ This path leads, inevitably, to geo-engineering – or rather, to further geo-engineering.²⁹ For, against the backdrop of our increasing awareness of its planetary consequences, what has our massive utilization of fossil fuels become but a kind of geo-engineering? The oceanographers Revelle and Suess observed in 1957 that “human beings are now carrying out a large-scale geophysical experiment ... that could not have happened in the past nor be reproduced in the future. Within a few centuries we are returning to the atmosphere and oceans the concentrated organic matter stored in sedimentary rocks over hundreds of millions of years.”³⁰ Doesn’t such a large-scale experiment sound like geo-engineering? That is not to say it’s a geo-engineering with a master engineer in charge. Like every human endeavor it’s been some combination of chosen and fallen into, conscious and unconscious. But so will any future geo-engineering be as well.

I dread the day when a rogue nation or trillionaire unilaterally commits earth to another uncontrolled experiment in the name of salvation. I dread the mind-set which imagines we’re sufficiently self-present to undertake the governance of the natural world, the dominion over the universe which Bacon prophesied,³¹ or which imagines that dominion is instead the province of AI. I dread the ideologies, so many already in circulation, which will justify any action in terms, not of the existential threat of a changing planet, but of the absolute supremacy of human beings and of sub-groups among

²⁸ This possibility is already nascent in Bacon, for example in the 129th aphorism of Book I of the New Organon, with its emphasis on the divine honors owed inventors and its claim that the benefits of these inventors’ discoveries serve all mankind and last all time.

²⁹ My objection to geoengineering is in the metaphysical comportment underlying it, as I will discuss later. Insofar as we foresee that our actions necessarily have planetary consequences and modulate (or don’t) those actions in accordance with the consequences we anticipate, we are in some fashion geoengineers – as I am suggesting here.

³⁰ *Tellus* (1957) 9(1): 18 – 27.

³¹ Aphorism 129 of Book 1 of The New Organon.

them. It seems to me this is the track we are most likely to follow, because of that Sirens' song it sings to us that we won't have to change – though that promise is a lie, and we will eventually discover ourselves as changed as Milton's fallen angels.

Among the forms of this techno-theology is the technological creation of illusions we desire – the technological creation of a cave we like. We don't want just to geo-engineer the world; we want to retreat from the world that is into one of our own devising. This comes to mind when I consider the Fabian allure of massive climate simulations, but no less when I consider the aptly-named Marvel Cinematic Universe. Or when I watch parents at playgrounds engrossed not by children but by phones.³² Or when I ponder why cars are so important to us, those wheeled would-be biospheres with their own entertainment systems and climate control. These are all, at least in part, escapes, caves we retreat to in order not to stare at the sun or to feel its heat. Fear no more the heat o' the sun, thinks Virginia Woolf's character Clarissa Dalloway as she prepares her party and contemplates her mortality; fear no more the heat o' the sun, thinks another of Woolf's characters, Septimus Warren Smith, even as he is about to plunge holding his treasure (**slide**). They're both quoting a line from a funeral dirge in Shakespeare's *Cymbeline*; and this retreat I'm describing, this techno-theological embrace of the cave, this path which I think we're mostly following, is in equal measure that song of sorrow which declares we are afraid to live. Well we should be! It takes gigantic courage to live even a single day.

That's the techno-theological path stretching before us – the path of technological illusion and of god-like faith in technology, but also of retreat into made-up worlds, the bubbles of social media, CGI and cars, while in our hearts suspecting this also deforms us and tears us apart. The other path, the more difficult and the more hopeful one, places the burden of response and responsibility not only on

³² We can no longer imagine even taking a neighborhood stroll without a computer in our pockets whose memory is millions of times, and processing speed hundreds of thousands of times, that of the computers which first put a man on the Moon. 10% of worldwide electricity generation goes into information and computing systems – according to Roy Scranton ([Learning to Die in the Anthropocene](#)), roughly the same amount of electricity as was needed to illuminate the globe in 1985.

technology, though we will need it, but on ourselves. It rejects that we are helpless to change or that our only hope of change is to convince politicians and corporations to make changes for us. We have become shockingly accustomed to imagining ourselves as mere followers and our politicians, for whom we frequently express disdain, as nonetheless leaders. They're not necessarily leaders; in this country, they are first and foremost our representatives. The difficult, more hopeful path begins by taking seriously that they do represent us; that corporations do too; that what we behold in them is a representation of what we are. While it's comforting and not wholly false to imagine tycoons making gazillions of dollars off of us helpless dupes, we must take seriously that what they sold us we also wanted.

Let me underline this point with a recent example. Darren Woods, CEO of ExxonMobil, excited outrage last month when he blamed the public for climate inaction: "The dirty secret nobody talks about is how much all this is going to cost and who's willing to pay for it. The people who are generating those emissions [i.e., all of us – LW] need to be aware of and pay the price for generating [them]. That is... how you solve the problem." Setting aside the likely hypocrisy, self-interest and poor faith of Woods' claim, we nonetheless need to hear its truth, rather than quickly condemning it as, according to *The Guardian* newspaper, "[an] attempt to skirt climate accountability."³³ Such condemnations are their own variety of skirting accountability. Indeed, the climate activist group 350.org specifically exonerated all of us when it used Woods' claim to motivate a petition which read, "Fossil fuel giants like ExxonMobil are to blame for the climate crisis – not us. If you agree, add your name" (**slide**).³⁴ Likewise *The Guardian* article cited a climate economist who compared Woods to a drug lord "blaming everyone but himself for drug problems." But if a drug lord is culpable, does that mean drug users are not? I am alarmed by so limited a notion of freedom, according to which we accept ourselves as powerless rather than endure even a

³³ I am referring to the article by Dharna Noor and Oliver Milman published on 3/4/24 in *The Guardian*

³⁴ I'm quoting their 3/15/24 email with the subject line "Exxon CEO just blamed the climate crisis on the public." A subsequent email on 3/23/24 expanded the list of the guilty: "Last month was the ninth consecutive hottest month on record, ever. The climate crisis is here, and the culprit is the fossil fuel industry. But they are not alone – utility companies are also responsible." Once again, however, we consumers are off the hook.

modicum of responsibility – as if freedom didn't imply responsibility but instead was freedom *from* responsibility.

This desired freedom from responsibility fuels the dream that we can meet the extraordinary challenges facing us without having to change substantively. We too easily accept that our civic responsibility is to consume rather than sacrifice, to vote on occasion, to write a check to a political candidate, PAC, party or charity or, less often, to go to a protest, even while none of these demands what is more fundamentally needed: that each of us change. Our response can't be an exception from our normal lives; *it has to be what's normal about them*. The assumption that the heavy-lifting can be accomplished only by governments or corporations exculpates us. It's not entirely untrue, which is why voting, donating and protesting matter, but it also basically assures the status quo while delivering us from having to consider how those governments and corporations truly represent us.

Part of what can be recognized in those representations is despair. It seems that we don't in our hearts believe we can change; it seems that in our hearts we accept that this representation, whether corporate or political, and despite regularly communicated contempt for it, still expresses the dark truth of who we are and of all we can become. We might as well resort to CGI creations of god-like superheroes because, despairing, we can't imagine ourselves as powerful agents otherwise. We have more faith in technology, including technological illusions, than in ourselves.

What if we were to put faith elsewhere than the technological divine? What might that look like? I have three suggestions, each both simple and on the far side of human possibility. If we take them seriously, we must also take seriously why they're on the far side of possibility.

The three suggestions are: Live small, not large. Live slow, not fast. Think differently. Rather than accepting the nihilistic premise that nothing you do matters, consider the exhilarating, terrifying premise that anything you do may matter. You may not know the ways it matters, to whom or to what. Mattering may not be reducible to meaning. But anything you do may matter, at least insofar as anything you do is

matter. This is a consequence and expression of finitude. If we and our world were infinite, we could subtract or add to that infinity without changing it. But we and our world are finite; we and it must change.³⁵ We are like that dream of Pierre described near the end of Tolstoy's War and Peace,³⁶ where he sees a living, wavering globe consisting of drops tightly packed together. Every drop which moves and shifts causes other drops to move and shift in turn. So it is in our lives: not one of us can move without moving something else. That seeming accident is a condition of possibility of every motion we make. Think about yourself finitely, pushing the earth to push off from it. An oil rig is not just ExxonMobil's; it also expresses you who are but several drops away. When you drive, your gasoline has travelled vast distances, and that's now part of your motion. That gasoline was once a fossil-fuel deposit; before that, it was a living being. Its carbon cycled many times through the food web, before getting buried and, over millions of years, being compressed and transformed into something else, which one day we sucked from the earth and transported across the globe so that the controlled oxidation of it would propel your vehicle while once again accomplishing a new transformation, spiritualizing what was once alive into the gas trees breathe and you and I exhale. Being finite means being part of this enormous web which you can't control or fully foresee, but within which you are not without freedom or responsibility.

This web, this unavoidable mediation which finitude implies, is what geo-engineering forgets. It's arguably what Descartes forgot.³⁷ Both secretly infinitize us; both imagine us as subjects fully present to ourselves for whom absolute agency is possible. For them, the drop each of us is doesn't shift or get shifted by other drops but is isolatable; no web inextricably entangles us; and hence, surveying all that is,

³⁵ As recognized by Pascal: "We are floating in a medium of vast extent...; whenever we think we have a fixed point to which we can cling and make fast, it shifts and leaves us behind... Nothing stands still for us. This is our natural state and yet the state most contrary to our inclinations" (Pensées 199, 'Disproportion of man,' translated by Krailsheimer). Physical conservation laws can also be interpreted as consequences of the finitude of the world.

³⁶ Vol. IV, Part 3, Chapter XV, pp. 1064-5, translated by Pevear and Volokhonsky.

³⁷ It's also what our ideology of perpetual growth forgets – an ideology central to capitalism. As for Descartes, his forgetfulness was not shared by his contemporary and critic, Pascal, who regularly linked finitude and mediation (or middle-ness), as in Pensées 199.

a subject can act with full consciousness. A subject can command itself to doubt; it can doubt away the entire world; and having found the seat of certainty in its own thinking, a disembodied and hence de-finitized thinking, it can then re-create and author the world. This is Descartes' trajectory in the Discourses and Meditations. It's also the trajectory of technological illusion, which would replace the world that is with the illusion of a world we author.³⁸ It's finally the trajectory, if not task, of geo-engineering. A famous climatologist³⁹ argued that, given climate's susceptibility to small changes of initial conditions, the so-called butterfly effect – where the flapping of a butterfly's wings in one place contributes to a hurricane elsewhere – given this susceptibility, he said, all we had to do was “tame this butterfly.”⁴⁰ Were this climatologist more of a poet, we might hear irony in his claim; but what we might hear poetically as articulating a hubristic and hopeless project can also be heard as the assignment. It imagines every butterfly can be tamed; but even more dangerously, it posits a tamer outside the web of mediations, a disembodied, decontextualized knower whose command to the legion of tamed butterflies is itself beyond the jostle of any neighboring drop (**slide**).

Think differently. Picture yourself as a drop jostled by and jostling its neighbors. We must relentlessly re-imagine ourselves thus. We must accustom ourselves regularly to undertake the thought experiment Rousseau challenges Emile with, in the book of that title:⁴¹ “We [i.e., Emile and his teacher] go to dine in an opulent home. We find the preparations for a feast... All this apparatus of pleasure and festivity has something intoxicating about it... While the meal continues, while the courses follow one another, while much boisterous conversation reigns... I lean toward [Emile's] ear and say, “Through how many hands would you estimate that all you see on this table has passed before getting here?” What a

³⁸ We tend to confuse our mediated and necessarily partial access to the world that is with our authorship of it. Finding ourselves in a synecdoche, we assume we're the poet.

³⁹ The climatologist was Kerry Emanuel; he made these comments during an interview on NPR's Fresh Air, August 1st, 2007. An audio file is available at <http://www.npr.org/templates/story/story.php?storyId=12421331>.

⁴⁰ “Is it by your wisdom that the hawk soars and spreads its wings out to the south?” Job 39:26.

⁴¹ Emile, Book III, p. 190 in Bloom's translation.

crowd of ideas I awaken in his brain...! Instantly all the vapors of the delirium are dispelled. He dreams, he reflects, he calculates, he worries. While the philosophers, cheered by the wine, perhaps by the ladies next to them, prate and act like children, he is all alone philosophizing... [W]hat will he think of this luxury when he finds that every region of the world has been made to contribute; that perhaps twenty million hands have worked for a long time; that it has cost the lives of perhaps thousands of men...?"

We must think in terms of twenty million hands and thousands of lost lives – not all of them human – and indeed those numbers are surely underestimates. Even when simply walking the placita, we should imagine that what energizes our steps were once living beings who stretched themselves toward the sun.⁴² We must as best we can make choices worthy of the sun-stretching creatures who enabled them, of twenty million hands and thousands of lost lives.

This is not an exhortation not to live, to deny ourself life, to do nothing because there is nothing untouched by twenty million hands and thousands of lost lives. Instead it's an exhortation to live up to those hands and lives. Derrida described such a comportment in these terms: "Il faut bien manger" he wrote, but also "il faut manger le bien"⁴³ – which as a play on words means several things: it means, of course we must eat, but we must also eat well – and not only that, we must eat the good. We must eat the good well. We must do it because we can't not do it. To be finite implies, inexorably, that we must eat the good, that no action is without reaction, no gain without loss. We can't not eat the good, we can't act in the world without the possibility of harm, we can't self-consciously leave no trace, nor is the trace which we *may* leave simply up to us. So what we can't not do let us do as well as we can (**slide**).⁴⁴

⁴² Mary Oliver's "Wild geese" comes to mind, especially the last sentence: "Whoever you are, no matter how lonely, / the world offers itself to your imagination, / calls to you like the wild geese, harsh and exciting – / over and over announcing your place / in the family of things."

⁴³ See Derrida's conversation with Jean-Luc Nancy entitled "Eating well, or the calculation of the subject" in Points, edited by Elisabeth Weber, especially pp. 277-87.

⁴⁴ The French uses the impersonal expression "il faut" where I use the pronoun "we." The "we" is problematic; there is a question of what or who "we" is, as there should also be a question of what eating is. Eating is not simply what subject does to object; eating changes both eater and eaten. The referent of "we" thus necessarily changes.

If this is not an exhortation not to live, neither is it an exhortation to embrace extravagance, to pronounce, like Louis the XVth, “After me the flood.” Look to the future: look not only at the hands and lives of those who have touched what is already before you, but also to the hands and lives of those yet to come, who not you but your choices will touch. What entangles us stretches from past to future. Our actions may memorialize and prophesize. It is in this context of an imagined future, moreover one which no longer includes you or me, as well as in the context of imagining our global contemporaries who even now live lives much less replete than ours, that it makes sense to live small and slow. Put simply, if you do, you will use less and leave others more.⁴⁵

What I’m suggesting may sound naïve, as if I’m unaware of the notorious problem of collective action. If each of our contributions is a mere drop in the ocean, why worry about my drop if no one else worries about theirs? This argument of apathy, however, is just the flip side of the infinitization I’m critiquing. It posits that the only options are to be infinite or nothing. Such a coarse dichotomy has long characterized our thought. For example, we have long believed we could dump waste into the ocean or atmosphere and that, in effect, it would be infinitely diluted – that the vastness of ocean or atmosphere would reduce it to nothing. But it was, in fact, finitely diluted. Slowly those drops accumulated, so that now, for example, plastic, invented in 1907, is found in every region of earth from the Himalayas to the deepest ocean trenches, as well as in our food, our bodies and our mothers’ milk, to say nothing of the atmosphere’s rising greenhouse gases (**slide**). This whole lecture is about taking that disproportion between nothing and the infinite, a drop,⁴⁶ seriously, about admitting that yes, you are a drop, but every drop matters, you matter. The pretense that drops don’t matter expresses, in one mode, a deluded if aggrandizing infinitization, as if we count but only as infinite; but in another mode, the complement of our aggrandizing delusion, it confines each of us to a cell of impotent isolation, where our drops don’t

⁴⁵ You’ll eat less good more well.

⁴⁶ “For, after all, what is man in nature? A nothing compared to the infinite, a whole compared to the nothing, a middle point between all and nothing...” Pascal, Pensées 199.

collectively constitute a wavering globe, much less our exalted, lonely individualities a world. But there is a world, a living, wavering globe of drops, in which each of us is a single drop who matters.⁴⁷ Live small and slow and think differently for that world.

This advice is more dramatic than it sounds. We easily dream of circumstances which will enable us to live as we imagine we like without unwanted consequences. This is like imagining ourselves disembodied, mattering without being matter, meaning immaterially. It articulates a desire that we not be finite or mortal. I suspect that we live large and fast partly to distract ourselves from that finitude, from the death which awaits, as a substitute for the gigantic courage it takes to live even a single day. Yet such a response accelerates catastrophe. The illusion that we're infinite, that change can happen without us changing, is not a salve for our fragile mortality but a destructive expression of it. It secretly confesses that none of us really believes we will die, as perhaps none of us really believes in climate change. There is another option: that we try to believe; that, trying to believe, we make an offering to the future and of the future;⁴⁸ that we not insist that future be ours; that we let it be someone else's.⁴⁹

The talk of a new green revolution sometimes sways this direction, but so long as it promises immense change which won't require *us* to change, it's a pipedream if not something more malevolent:

⁴⁷ This may signal a return to the sacred, if we accept Amitav Ghosh's suggestion (*op. cit.*): "It is impossible to see any way out of this crisis without an acceptance of limits and limitations, and this in turn is, I think, intimately related to the idea of the sacred..." (p. 161).

⁴⁸ The French scholar Rémi Brague gave a lecture at St. John's (Santa Fe) many years ago in which he identified as one of the crises of modernity the decline in the human birth rate. He interpreted this decline as expressing despair about the future, as articulating that we no longer believe in a future worth giving. I agree with such a diagnosis of despair; I agree as well that it behooves us to believe in a future worth giving, *and to do the hard things such a belief demands*, but, contra Brague, I think it imperative that we appreciate that the recipients of such a gift are not, and cannot be, restricted to human beings. Indeed we can no more know the recipients than the future.

⁴⁹ One is always at risk of re-infiniteing the subject. Letting the future be someone else's still secretly assumes the future is mine to yield. Even just letting the future be may fall into this conundrum. It's reminiscent of the catch-22 in Faulkner's *Go Down, Moses*, where Isaac – whose apt Biblical name invokes the possible sacrifice of both past and future – endeavors to relinquish his patrimony but can't escape thinking that it is his to relinquish. As a result, his may still be a version of thinking infinitely, albeit in a negative mode, rather than thinking finitely. Perhaps Molly comes closer to the latter, she who "dont want nothing" (p. 97), mistrusts a divination which has become of gold rather than god, and at the end of the book keens for her Benjamin, sold into slavery and dead. But the spiritual "Go Down, Moses," for which the book and the last tale are both named, still suggests a future organized by a promise, a promise clearly not met by the book's end but, like Isaac's patrimony, not truly relinquished either.

a future we pretend to yield to an other while secretly and stubbornly insisting it remain ours.⁵⁰ That pipedream pretends that massive solar arrays, nuclear power, windmills, hydrogen, etc., will allow us to build for the future without giving up that future to someone else;⁵¹ it pretends we can be responsible to the future without really changing our present, including without decreasing our consumption. Take energy for example. We may dream that someday it will be boundless and free, but it won't be. Energy will always come with consequences. Its production and use will require a material infrastructure likely including fossil-fuel-intensive steel, concrete and plastic. It will generate waste, including, for nuclear energy, dangerous radioactive products whose half-lives can far exceed the history of human civilization.⁵² We shouldn't overlook that hydrogen, if it's to be our panacea, is a highly explosive panacea. And if a butterfly can cause a hurricane, what can a windmill do (**slide**)? Put otherwise, don't look to get something for nothing;⁵³ that only amounts to the illusion of a good conscience.⁵⁴ Don't trick

⁵⁰ Such a situation, including its unfurling ramifications, is well-described again in *Go Down, Moses*, as in this passage from "The Bear" (pp.257-8): "...old Carothers' bold cramped hand far less legible than his sons' even and not much better in spelling, who while capitalizing almost every noun and verb, made no effort to punctuate or construct whatever, just as he made no effort either to explain or obfuscate the thousand-dollar legacy to the son of an unmarried slave-girl, to be paid only at the child's coming-of-age, bearing the consequence of the act of which there was still no definite incontrovertible proof that he acknowledged, not out of his own substance but penalizing his sons with it, charging them a cash forfeit on the accident of their own paternity; not even a bribe for silence towards his own fame since his fame would suffer only after he was no longer present to defend it, flinging almost contemptuously, as he might a cast-off hat or pair of shoes, the thousand dollars which could have no more reality to him under those conditions than it would have to the negro, the slave who would not even see it until he came of age, twenty-one years too late to begin to learn what money was."

⁵¹ Hence the college's thoughtless slogan campaign tying "Building for the future" to "St. John's forever."

⁵² Iodine-129 has a half-life of almost 16 million years, for example.

⁵³ To get something for nothing implies an infinity, while suggesting simultaneously how nigh nothing is to anything.

⁵⁴ Consider carbon offset programs. The science behind these has always been suspect, with concerns about whether they can be done at the necessary scale in the right places, how long-lasting savings will be and whether savings can accurately be determined. Yet worse is the world's largest carbon offset firm, South Pole, selling carbon credits for reductions which *they knew didn't exist* (Blake, "The great cash-for-carbon hustle," *The New Yorker* 10/16/23). More broadly, however, the problem lies in our failure to recognize that responsibility is always *excessive*. To measure and delimit it is to turn any responsibility into the alibi for irresponsibility, as we saw above in the 350.org petition. Appreciating responsibility as necessarily excessive is a corollary of understanding that what we eat, what we internalize and make our own but also at the same time destroy, is in fact the good, for the loss of which there is no compensation. The pretense at the core of capitalism (but also of prevailing notions of justice), that no loss is without compensation (whether in the mode of offsets or criminal penalties) *implies irresponsibility*.

yourself into believing you can give to the future without giving something up.⁵⁵

Here's a more tangible form of this advice: we must pair attempts to choose energy sources more wisely with concerted efforts to *use* them more wisely – and specifically to *reduce* how much energy and matter we use. I'm ambivalent but partly glad that the St. John's Santa Fe campus has gone solar. I'd be more glad and less ambivalent if our solar conversion were accompanied by a campaign to reduce our energy use, if our murals enjoined us to take the next step rather than extolled the step already taken (**slide**). Per capita energy consumption in the United States is among the highest of any nation. If we want to limit ourselves to "only" 1.5 or 2°C of warming – as dangerous as that may be – if we want to reduce global fossil fuel emissions by 50% in the next 6 years, *we can't do it* without dramatically reducing how much energy we use in ways which will present real but surmountable problems. Other first-world countries⁵⁶ consume per capita half the energy which Americans consume. I grant substantive differences exist between us and them, but it seems to me the most stubborn impediment to making real reductions in our energy consumption is not those differences but our unimaginative and fantastical insistence that we shouldn't have to change. As a result, so much of the rest of the world strives to live like us, when we desperately need to live more like them. Gandhi worried in 1928, "God forbid that India should ever take to industrialism after the manner of the West... It would strip the world bare like locusts."⁵⁷ But India and China and much of the world *have* taken to western-style industrialism, and that stripped world which Gandhi dreaded is increasingly the reality before us, as the rest of the world follows our example while we refuse to follow theirs (**slide**).

My argument for living small and slow is not just that there's no other way to face the

⁵⁵ Technology is the claw by which we bring the future closer. It's a way of materializing time, even commodifying it. We should wonder whether the technological solution isn't always at the expense of the future. If we admit, however, that technology is an inevitable aspect of what we are, we will also have to admit that we are *always* expending the future in some form. This again comes down to eating the good but endeavoring to eat it well.

⁵⁶ For example, Germany and France.

⁵⁷ As quoted by Amitav Ghosh (*op. cit.*), p. 111.

extraordinary challenges before us and no better way to accustom ourselves to the lives we will eventually have to lead. It's also not just an ethical argument about living up to twenty million hands and thousands of lives past and future. The third prong of my argument is what I've been saying about how the world reflects us. As much as we may want to blame governments, corporations, even capitalism, and as much as none of those are without blame, we still must take seriously that these reflect us. They express something that we must take responsibility for as our own. Our words may say, "End fossil fuels," but our actions take for granted their ready abundance. The only way I see to change that is to change how we consume (eat), live and think. We can't just talk about this; we have to *do* it. That means recognizing no one is without responsibility for our predicament. Typically, if no one is without responsibility, no one is held responsible. But I'm saying each of us must hold ourself responsible.⁵⁸

Change is coming, whether we give assent or not. If we try to affirm it, we need to do more than vote, donate, protest or go solar. We need to change. This may not sound revolutionary compared to a new green revolution – but of the two (which aren't mutually exclusive), I'm advocating the essential one. I'm not saying it will be sufficient if enough of us do our small part. Other things need to happen, including at corporate and political scales. But those things will not happen if enough of us don't do our small part. As much as we may like to believe we are victims of capitalism run amok, of ExxonMobil, of politicians, these also mirror us. They show us versions of ourselves.⁵⁹ They give us what we, at least in part, ask for. Ask for something else. Become something else. Corporations, governments and economic systems aren't simply *controlling* us; they're also *expressing* us. Any revolution without that admission is just a spinning of wheels. Some of the dread darkness of the political era into which so much of the

⁵⁸ To suppose that I should not act until those act who have behaved even less responsibly than me is to place the burden of our collective response on those who have behaved the absolutely least responsibly.

⁵⁹ My insistence, or at least invitation, that we recognize our corporate, political and economic reflections runs the risk of becoming a kind of consumption or subsumption, a gobbling up of the other as secretly, within a naïve idealism, the same; yet the other which reflects us in myriad ways need not *only* be our reflection, nor is it clear that in a reflection what is seen is same and not other.

world is falling stems from our propensity first to alienate, then to vilify, our own reflections – while also believing that it is only those reflections which have the freedom, power and burden of responsibility.⁶⁰

What I've said today is not just about climate change. It's about how we are using up and running down the earth and, in parallel, exalting and diminishing ourselves. We see the earth as a pantry for us to raid; and as various stocks within it become depleted, we don't question our behavior or assumptions but merely look for new stocks. For the most part we have not interrogated our prejudice that we are entitled to the earth, that it is ours to exhaust, that no other beings besides human beings – and perhaps even among them only some – truly matter (**slide**). This exaltation we've implicitly bestowed upon ourselves is a kind of self-infinitezation, whereby even the governance of the natural world falls under our thinly secularized techno-theological sway; but in lock-step with it comes our diminishment as isolated individuals, impotent and unfree, incapable of response and of responsibility, in effect nullities. Cast between these overtly dueling but secretly linked poles of the infinite and nothing, climate change becomes an avatar of our finitude. Ignore the avatar and the threat will not retreat; but neither will it retreat should the avatar be addressed. That desired retreat follows from the false premise that our finitude is escapable. It is not. We are neither infinite nor nothing but, drop-like, between the two. We need a response which endures that disproportion rather than, through fantasy and denial, embraces one end member or the other, thereby accelerating and compounding catastrophe. Some will hear me as prophesying doom, but I am actually advocating hope – not an easy hope, not a hope without effort or struggle or loss, not an empty hope which consoles by anesthetizing, but the harder and truer hope which admits that we must change – and that we can.

Something new is coming, just as it did at the end of the Cretaceous 65 million years ago in the form of an asteroid. That asteroid augured both calamity and immense possibility, the end or

⁶⁰ If we live in a benighted age, the question still remains: how far advanced is the night? Could we perhaps even now be on the cusp of dawn?

transformation of the dinosaurs,⁶¹ and the rise and transformation of the mammals. From it was born the once-new world we recognize and sometimes love. A thin layer of the element iridium is sprinkled across the planet, marking that event and the boundary separating a world familiar to dinosaurs from one more familiar to us. Many now claim that we've entered a new geological epoch called the Anthropocene. Since epochs typically last hundreds of thousands to tens of millions of years, I'm struck by the sheer optimism of that designation, which I find both endearing and repellent. How innocent and how hubristic that we think it's an epoch! It strikes me as far more likely that the Anthropocene will have been a boundary event like the impact at the end of the Cretaceous,⁶² marked by a layer not of iridium but of plastic, and distinguishing yet another new world from our now-old and familiar one. This new world may not be ours. It doesn't need to be ours. A new world which includes us can't only be ours. Like the dinosaurs, if we⁶³ are to persist, we must become something different, something smaller, something which, though almost as light as air, nonetheless greets mo(u)rning with song (**slide**).⁶⁴

⁶¹ How to read "or"? Transformation may be an alternative to extinction, to an end, but it is also a specific form of the end. The first reading reads continuity where the second reading reads discontinuity.

⁶² The Anthropocene as a boundary event was initially suggested by Scott Gilbert, per Donna Haraway (2015) *Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin. Environmental Humanities* 6: 159 – 65.

⁶³ Don't overlook that the pronoun in this final sentence, despite its seeming stability, refers to things in flux. Its referent is changing (as is characteristic of pronouns). See also the footnote on p. 16 about translating "il faut (bien) manger (le bien)."

⁶⁴ Every new beginning also marks a loss.