

TFOES WIMM VSMOOC Book Quotes Part 3 assembled 2020-01-26 PDF 2024-05-07

Excerpts collected From October 2018 to 2020

from "After Nature: A Politics for the Anthropocene" by Jedediah Purdy

"Aesthetics does not need to be ethical, and when artists try to make it do ethical or political work, the result is often to do no good. But let us say we want another way to see the energy economy whole, as the food movement has been teaching us to see the overall food economy. That project might benefit from what the food movement has helped to create: an aesthetics that responds to resilience, health, and mutuality among species and ecosystems. That new aesthetics in agriculture is now part of the cultural basis for a new politics and a possible new period of law reform around the food economy. **The energy economy has no such thing. Much of it remains invisible and, mainly, unimagined. A beginning would be to imagine the world's possible energy futures as alternative landscapes, alternative economies, alternative ways of living in the full sense of a political economy that is also an ecology.** A coal economy implies a form of landscape and a kind of life. So does a petroleum economy—a fact that has become newly vivid as fracking has taken natural-gas drilling into regions that had previously not seen much of it, unsettling the feeling of immunity that had prevailed there. As with coal and oil, so with wind and solar energy. Each has its own versions of destruction, its own kinds of beauty, and its own forms of human work. **Some of these are familiar, and some are strange. Whoever wants to contribute to an Anthropocene politics had better start developing ways of imagining them all, and of bending our work toward some of them.**"

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from "Sustainability (Key Concepts)" by Leslie Paul Thiele

"It must foster a sense of responsibility, develop investigative and problem-solving skills, and cultivate the experience of empowerment or agency. Only in this way will complex threats be met with informed, collaborative, effective responses. Sustainability education faces a unique challenge in this regard. Noting that the best educated in society—namely those who graduate with degrees from the most prestigious institutions of higher education—are generally the most profligate consumers of precious resources, David Orr writes that "It is not education, but education of a certain kind, that will save us."

The kind of education that Orr has in mind develops investigative and problem-solving skills and instills a sense of responsibility and empowerment. ***Environmental educator C. A. Bowers writes of the need for a curriculum that "provides both the experience of being an interdependent member of a human/ biotic community***

and an understanding that interdependence is the basic relationship that connects past, present, and future generations.” 36

What is required is a “schooling for interdependence” that encourages and empowers people to understand, navigate, safeguard, and transform the connections that define their world. 37 An education in interdependence is inherently difficult to provide in a formal institutional setting. For the most part, our schools and institutes of higher education are places students go to learn, not to live. Yet the breadth and depth of our lived interdependencies are most fully experienced in the nested communities that daily sustain us.”

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from "The Vortex of Violence: and why we are losing the war on climate change" by Kevin Lister

When this is considered in the context of geological time periods, the super exponential rise of CO 2 becomes is even more evident. The Vostok ice core data taken from the glaciers of the Antarctic shows how stable CO 2 was until the industrial revolution. Since then its increase has been virtually instantaneous and explosive when considered on a geological timescale and it is to a level unprecedented in global history.”

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Capra, Fritjof. The Systems View of Life: A Unifying Vision (p. 355). Cambridge University Press. Kindle Edition.

All the principles of ecology mentioned so far are closely interrelated. They are just different aspects of a single fundamental pattern of organization that has enabled nature to sustain life for billions of years. In a nutshell, nature sustains life by creating and nurturing communities. Sustainability is not an individual property but a property of an entire web of relationships. It always involves a whole community. This is the profound lesson we need to learn from nature. The way to sustain life is to build and nurture community. A sustainable human community interacts with other communities – human and nonhuman – in ways that enable them to live and develop according to their nature.

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Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist by Kate Raworth Kindle page 824

Imagine, then, if ours could be the turnaround generation that started putting humanity on track for that future. What if we each were to mentally map our own lives on to the Doughnut, asking ourselves: how does the way that I shop, eat, travel, earn a living, bank, vote and volunteer affect my personal impact on social and planetary boundaries? What if every company strategised around a Doughnut table, asking itself:

is our brand a Doughnut brand, whose core business helps to bring humanity into that safe and just space? Imagine if the G20 finance ministers—representing the world's most powerful economies—met around a Doughnut-shaped conference table to discuss how to design a global financial system that served to bring humanity into that sweet spot. These would be world-changing conversations.

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Monibot article Guardian

The central image in mainstream economics is the circular flow diagram. It depicts a closed flow of income cycling between households, businesses, banks, government and trade, operating in a social and ecological vacuum. **Energy, materials, the natural world, human society, power, the wealth we hold in common: all are missing from the model. The unpaid work of carers – principally women – is ignored, though no economy could function without them.** Like rational economic man, this representation of economic activity bears little relationship to reality.

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from "The Great Derangement: Climate Change and the Unthinkable (Berlin Family Lectures)" by Amitav Ghosh

"3. That climate change casts a much smaller shadow within the landscape of literary fiction than it does even in the public arena is not hard to establish. To see that this is so, we need only glance through the pages of a few highly regarded literary journals and book reviews, for example, the London Review of Books, the New York Review of Books, the Los Angeles Review of Books, the Literary Journal, and the New York Times Review of Books. When the subject of climate change occurs in these publications, it is almost always in relation to nonfiction; novels and short stories are very rarely to be glimpsed within this horizon. Indeed, it could even be said that fiction that deals with climate change is almost by definition not of the kind that is taken seriously by serious literary journals: the mere mention of the subject is often enough to relegate a novel or a short story to the genre of science fiction. It is as though in the literary imagination climate change were somehow akin to extraterrestrials or interplanetary travel.

There is something confounding about this peculiar feedback loop. It is very difficult, surely, to imagine a conception of seriousness that is blind to potentially life-changing threats. And if the urgency of a subject were indeed a criterion of its seriousness, then, considering what climate change actually portends for the future of the earth, it should surely follow that this would be the principal preoccupation of writers the world over—and this, I think, is very far from being the case. But why? Are the currents of global warming too wild to be navigated in the accustomed barques of narration? But the truth, as is now widely acknowledged, is that we have entered a time when the wild has become the norm: if certain literary forms are unable to negotiate these torrents, then they will have failed—and their failures will have to be counted as an aspect of the broader imaginative and cultural failure that lies at the heart of the climate crisis."

But why? Are the currents of global warming too wild to be navigated in the accustomed barques of narration? But the truth, as is now widely acknowledged, is that we have entered a time when the wild has become the norm: if certain literary forms are unable to negotiate these torrents, then they will have failed—and their failures will have to be counted as an aspect of the broader imaginative and cultural failure that lies at the heart of the climate crisis.

Clearly the problem does not arise out of a lack of information: there are surely very few writers today who are oblivious to the current disturbances in climate systems the world over. Yet, it is a striking fact that when novelists do choose to write about climate change it is almost always outside of fiction. A case in point is the work of Arundhati Roy: not only is she one of the finest prose stylists of our time, she is passionate and deeply informed about climate change. Yet all her writings on these subjects are in various forms of nonfiction. Or consider the even more striking case of Paul Kingsnorth, author of *The Wake*, a much-admired historical novel set in eleventh-century England. Kingsnorth dedicated several years of his life to climate change activism before founding the influential Dark Mountain Project, “a network of writers, artists and thinkers who have stopped believing the stories our civilization tells itself.” Although Kingsnorth has written a powerful nonfiction account of global resistance movements, as of the time of writing he has yet to publish a novel in which climate change plays a major part.

I too have been preoccupied with climate change for a long time, but it is true of my own work as well, that this subject figures only obliquely in my fiction. In thinking about the mismatch between my personal concerns and the content of my published work, I have come to be convinced that the discrepancy is not the result of personal predilections: it arises out of the peculiar forms of resistance that climate change presents to what is now regarded as serious fiction.

4. In his seminal essay “The Climate of History,” Dipesh Chakrabarty observes that historians will have to revise many of their fundamental assumptions and procedures in this era of the Anthropocene, in which “humans have become geological agents, changing the most basic physical processes of the earth.” I would go further and add that the Anthropocene presents a challenge not only to the arts and humanities, but also to our commonsense understandings and beyond that to contemporary culture in general.

There can be no doubt, of course, that this challenge arises in part from the complexities of the technical language that serves as our primary window on climate change. But neither can there be any doubt that the challenge derives also from the practices and assumptions that guide the arts and humanities. To identify how this happens is, I think, a task of the utmost urgency: it may well be the key to understanding why contemporary culture finds it so hard to deal with climate change. Indeed, this is perhaps the most important question ever

to confront culture in the broadest sense—for let us make no mistake: the climate crisis is also a crisis of culture, and thus of the imagination.

Culture generates desires—for vehicles and appliances, for certain kinds of gardens and dwellings—that are among the principal drivers of the carbon economy. A speedy convertible excites us neither because of any love for metal and chrome, nor because of an abstract understanding of its engineering. It excites us because it evokes an image of a road arrowing through a pristine landscape; we think of freedom and the wind in our hair; we envision James Dean and Peter Fonda racing toward the horizon; we think also of Jack Kerouac and Vladimir Nabokov. When we see an advertisement that links a picture of a tropical island to the word paradise, the longings that are kindled in us have a chain of transmission that stretches back to Daniel Defoe and Jean-Jacques Rousseau: the flight that will transport us to the island is merely an ember in that fire. When we see a green lawn that has been watered with desalinated water, in Abu Dhabi or Southern California or some other environment where people had once been content to spend their water thriftily in nurturing a single vine or shrub, we are looking at an expression of a yearning that may have been midwived by the novels of Jane Austen. The artifacts and commodities that are conjured up by these desires are, in a sense, at once expressions and concealments of the cultural matrix that brought them into being.

This culture is, of course, intimately linked with the wider histories of imperialism and capitalism that have shaped the world.

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from "Abundance: The Future Is Better Than You Think" by Peter H. Diamandis, Steven Kotler

"We will soon have the ability to meet and exceed the basic needs of every man, woman, and child on the planet. Abundance for all is within our grasp. Breaking down human needs by category—water, food, energy, health care, education, freedom—Diamandis and Kotler introduce us to dozens of innovators and industry captains making tremendous strides in each area:"

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from "The Optimistic Environmentalist" by David R. Boyd

"EXPERTS HAVE IDENTIFIED five business models based on circular economy principles: circular supplies, resource recovery, products as services, product life extension, and sharing platforms. Circular supply companies provide renewable energy, bio-based (compostable) materials, or fully recyclable substances such as aluminum to replace fossil fuels and single-use materials. Resource recovery firms find value in recovering or repurposing materials previously considered wastes or by-products. Retailer H& M collects used clothing in its stores to remake into new garments, closing the loop in textile production. Companies that offer services instead

of products shift incentives so that longevity and recyclability are top priorities. Carpet companies like Interface and Desso are using this approach, leasing carpets instead of selling them, while Philips is doing the same with lighting and Michelin with tires (fleet customers pay for miles driven instead of owning the tires). Product life extension focuses on making items durable instead of disposable. Some motor vehicle companies remanufacture parts that meet the same performance standards and carry the same warranty as new parts but without new materials and at half the cost. European carmaker Renault has achieved reductions of 80 percent for energy, 88 percent for water, and 77 percent for waste by remanufacturing rather than making new components. Gazelle, the leading web-based electronics recycling company in the U.S., buys and resells used gadgets, keeping millions of phones and tablets out of the waste stream."

Sharing platforms encourage the increased use of products that otherwise are underutilized. Collaborative business models are on the rise, such as car-sharing through companies like Autoshare or Zipcar, smartphone based ride-sharing such as Uber and Lyft, or renting out private homes or rooms through Airbnb and its competitors. ParkFlyRent is a business that allows people to park at airports and earn income while they are away by renting their car to others. These new enterprises are the beginning of an emerging sharing economy that, according to the founders of Gazelle, "changes the way we all think about buying, owning, selling, and recycling." Sharing also works on a non-business model too, as libraries have long demonstrated. The library model is being expanded to include items ranging from tools to kitchen equipment. Our Pender Island community has an apple juice press and a food dehydrator that all residents are welcome to borrow. Like many small communities, we have a thrift store (called the Nu-to-Yu) that collects and resells items ranging from toys to clothing. Although Pender's population is only 2,500 full-time residents, the Nu-to-Yu has donated over \$ 1 million to island charities and projects. Websites that facilitate the sale of second-hand merchandise, from eBay to Craglist, are making it easier than ever to buy and sell used goods. A study released in 2015 reported that Canadians spend over \$ 30 billion on secondhand goods annually. The leaders in circular economy innovation are Europe (at both the EU and national levels), Japan, and China. Europe recognizes that current levels of consumption must be reduced to offset the burgeoning environmental pressures created by the economic growth of developing countries. In 2012, the European Commission stated, "In a world with growing pressures on resources and the environment, the EU has no choice but to go for the transition to a resource-efficient and ultimately regenerative circular economy." In proposing a set of circular economy targets for 2030, European Environment Commissioner Janez Potocnik said, We are living with linear economic systems inherited from the 19th century in the 21st-century world of emerging economies, millions of new middle class consumers, and inter-connected markets. If we want to compete, we have to get the most out of our resources, and that means recycling them back into productive use, not burying them in landfills as waste. Moving to a circular economy is not only possible, it is profitable, but that does not mean it will happen without the right policies.

Boyd, David R.. The Optimistic Environmentalist (Kindle Locations 963-970). ECW Press. Kindle Edition.

Boyd, David R.. The Optimistic Environmentalist (Kindle Locations 961-963). ECW Press. Kindle Edition.

Boyd, David R.. The Optimistic Environmentalist (Kindle Locations 952-961). ECW Press. Kindle Edition.

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from "Your Atomic Self: The Invisible Elements That Connect You to Everything Else in the Universe" by Curt Stager

"When viewed from a great distance the sky resembles a shockingly thin film, and most of its molecules are packed into a mere ten-mile slice of a total planetary diameter of nearly eight thousand miles. At sea level you might find more than ten trillion trillion atoms in a cubic yard of air, but just outside that vaporous skin is the relative vacuum of the solar system, in which fewer than a dozen atoms might enter each of your lungs should you try—and fail—to breathe out there. The next time you see a photo of the earth taken from space, try to convince yourself that a pollutant-spewing smokestack anywhere in the world doesn't unleash potentially harmful substances into the same precious air supply that keeps you and your loved ones alive."

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from "Your Atomic Self: The Invisible Elements That Connect You to Everything Else in the Universe" by Curt Stager

"It is often said that forests are the "lungs of the planet" because they produce oxygen that we breathe, but the metaphor falls short in some respects. Lungs don't produce oxygen but instead consume it, and Keeling's work has shown that only about half of your oxygen comes from terrestrial plants. The rest is made by algae and cyanobacteria in lakes and oceans, with a small additional measure produced by the splitting of water vapor in the upper atmosphere by radiation from the sun and distant stars. However, when combined with the carbon dioxide analyses that his late father, Charles David Keeling, launched at Mauna Loa Observatory in Hawaii in 1958, the long-term oxygen records do show an almost eerie resemblance to the readouts of a medical breath-monitoring device. Annual pulses of oxygen are mirrored by cyclic drops in CO₂, and together these data open a unique window on the atomic connections between plants and the earth."

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Clark, Timothy. Ecocriticism on the Edge: The Anthropocene as a Threshold Concept (Kindle Locations 54-62). Bloomsbury Publishing. Kindle Edition.

However, the twenty-first century has seen an increased awareness of forms of environmental destruction that cannot immediately be seen, localized or, by

some, even acknowledged. Phenomena such as ocean acidification, climate change, the general effects of incremental forms of ecological degradation across the planet, global overpopulation and resource depletion do not present any obvious or perceptible target for concern or protest at any one place, or often any immediate antagonist perceptible at the normal human scale. The largely benumbed recognition of this reality has become one feature of life in the so-called Anthropocene, to use the currently still informal term for the epoch at which largely unplanned human impacts on the planet's basic ecological systems have passed a dangerous, if imponderable, threshold. **One major new effort at work in contemporary literary and artistic practice and criticism is to find some way of usefully or authentically engaging such crucial but elusive concerns, precisely when it is acknowledged that they resist representation at the kinds of scale on which most thinking, culture, art and politics operate.**

Clark, Timothy. Ecocriticism on the Edge: The Anthropocene as a Threshold Concept (Kindle Locations 67-75). Bloomsbury Publishing. Kindle Edition.

This involves tracing closely the way in which received or mainstream modes of reading and criticism, even when socially 'progressive' in some respects, are now, despite themselves, being changed into what are effectively implicit forms of denial as the world alters around them.

The Anthropocene is both frightening and intellectually liberating: the uncertainty and incalculable complexity of the issues, especially in forecasting likely future climates or the effects of human action or inaction, impel the resulting discussions in opposing directions. The first is the sense of being overwhelmed, of paralysis, even despair – how can you engage issues that are implicated in multiple events and behaviours and natural processes across the whole planet? To deny this is to evade the nature and urgency of the situation. Secondly, however, the very uncertainties can be intellectually liberating. The breakdowns of inherited demarcations of thought can still become a means of disclosure and revision, tempering the sense of alarm with a host of new insights.

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from "The Big Thirst: The Secret Life and Turbulent Future of Water" by Charles Fishman

"it is captured in that perfectly turned slogan: "It's water. Of course it's free." Although we don't often realize it, free isn't that great. The lack of a price, on water or on any other resource, leads to all kinds of inequities and inefficiencies. Water may be the most vital substance in every aspect of human endeavor, but the economics of water is a mash-up of tradition, wishful thinking, and poor planning."

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from "Ecocriticism on the Edge: The Anthropocene as a Threshold Concept" by Timothy Clark

"To contemplate the sight of the whole Earth is to think the disjunction between individual perception and global reality, a disjunction that has now become so consequential in the Anthropocene. The scale at which one speaks of oneself as a person-with-a-world may be constitutively opaque to understanding beyond a now dangerously narrow spatial-temporal window. David Wood writes: If my tree is dying, I notice. But the earth slowly dying is not obvious, not something I can see at a glance out of my window . . . There is a gap between what I can see and what may really be happening. The glance is ripe for education. 15 The phenomenal self-evidence of my singular world is itself a scalar effect unable, so to speak, to see itself as such. So we must take issue with the work of green thinkers such as David Abram who try to defend the immediate life-world of embodied perception as a kind of norm from which we have strayed into forms of destructive scientism and 'abstractions'."

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Coming of Age at the End of Nature: A Generation Faces Living on a Changed Planet (p. 14). Trinity University Press. Kindle Edition.

At that moment, I'm struck by the yawning gap that exists between ambitious, world-changing visions and the backbreaking, tedious work required to realize them.

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Chapter 7

**Suspicion toward Science and the Role of Automatic Intuitions about Origins
Elisa Järnefelt Thesis? or paper?**

Instead of understanding physical-causal mechanisms, both natural processes are often construed in terms of purposes and intentions.

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The Shape of Culturally Successful Information

Why do people prefer and trust one kind of information over another? To better answer this question, it is necessary to acknowledge the difference between automatic intuitions and reflection (Sperber, "Intuitive"). This division refers to people's ability to form information via (at least) two different cognitive processes: system 1 and system 2. System 1 processes are instant, beyond one's conscious control, and produce representations about immediate reality. System 2 processes require full attention, reflection, and effort and are more slow and sequential but also allow one to assess, consciously endorse, or momentarily inhibit ideas that are automatically formed via system 1 (J. Evans, "Dual-Processing"; Stanovich; Kahneman; see also E. M. Evans in this volume).

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Sperber, together with Hugo Mercier (“Intuitive” and “Why”), discusses this kind of pattern in people’s reflection in reference to “epistemic vigilance” (Sperber et al., “Epistemic”). *People are cautious toward information that is transmitted by other people. Reliance on abstract cultural information and not having to learn everything in the world firsthand is obviously a great advantage. However, when relying on abstract communicated information or other people’s accounts of reality, one is at constant risk of hearing someone who is misinformed, or even worse, is intentionally deceptive and lying.* Given this, Mercier and Sperber (“Intuitive” and “Why”; Mercier, “Reasoning” and “The Social”; Sperber et al., “Epistemic”) point out that people constantly watch over whether they can trust the information and the informant. What serves as an instant anchor are the thoughts one already has—system 1 automatically formed intuitions. Young children are already selective in their trust and doubt reliable informants or majority opinion when it violates untaught intuitive assumptions about the environment (Clément et al.; Seston and Kelemen). *Similarly, adults are less likely to accept information if it is not in line with instantly remembered background information, if formation of spontaneous inferences based on the new information is difficult, and if the information is not accepted by most of their peers* (Mercier, “Reasoning” and “The Social”; Mercier and Sperber, “Intuitive” and “Why”; Sperber et al., “Epistemic”)

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Moore, Kathleen Dean. Great Tide Rising: Towards Clarity and Moral Courage in a time of Planetary Change (pp. 287-288). Counterpoint. Kindle Edition.

HAVING SAID ALL this, having laid the blame for the carbon catastrophe at the big feet of Big Oil, having insisted on the right to lay blame, I have to admit that none of us, you or I, get off the hook. The complication is that none of my individual acts—say I drive to the grocery when I could walk; say I buy a pineapple from Hawaii instead of an apple from Oregon—are noticeably harmful in and of themselves. It’s hard to say that I’m intending harm; surely I’m not. It’s hard to say that I’m doing much harm; in an intriguing analysis, climate and energy writer David Roberts does the math and calculates that the average American family each year is responsible for one 13.75 billionth of the increase in excess greenhouse gases. I can’t vouch for that exact figure; the point is that none of us is doing much harm, but in the aggregate, over time, around the world, individual acts taken all together are empowering the carbon industries’ destruction of the Earth. How can we puzzle through moral responsibility in a case like this?

Moore, Kathleen Dean. Great Tide Rising: Towards Clarity and Moral Courage in a time of Planetary Change (pp. 289-290). Counterpoint. Kindle Edition.

What lifts my spirits is knowing that positive change works the same exponential way. If the Earth makes the Great Turning, it will not be because of one xeriscaped front yard plus one wind turbine plus one local farm plus one redesigned cookstove, and on and

on. It will be because imagination creates more imagination, good creates more good, respect for the land creates more respect, in a swirling whirlwind of change that sweeps away business-as-usual and upends the culture of reckless exploitation. Even as we approach a tipping point in runaway climate change, we are approaching a tipping point in the human conscience. What has been stony denial or astonishing indifference has become a worldwide movement for climate justice and ecological wholeness. We have met the enemy, and he may or may not be us. But we have also met the change-makers, and they definitely are us.

Moore, Kathleen Dean. Great Tide Rising: Towards Clarity and Moral Courage in a time of Planetary Change (p. 298). Counterpoint. Kindle Edition.

SO WE FIND our stone. And we chuck it in. Then we find another. This is the work of conscientious refusal, the steadfast refusal to let a hell-bent economy force us to row its boat. This is the work of creative disruption, turning the destructive energy of the fossil fuel industry into a new dynamic that replaces itself with something lasting. This is the work of courageous, relentless citizenship, pushing, requiring, demanding that elected government protect the commons: the atmosphere, the stable climate, the freshwater, the fertile soil, the great biodiversity of life, and this most important shared value, the future.

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"2 The Secret Life of Water" from "The Big Thirst: The Secret Life and Turbulent Future of Water" by Charles Fishman

WHAT A CHAPTER. WHEW. WONDERFUL. AND SO THOUGHT PROVOKING... from Ben

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From Preface to GREAT TIDES RISING: TOWARDS CLARITY AND MORAL CHANGE IN A TIME OF PLANETARY CHANGE by Kathleen Dean Moore

So here is what I have been thinking and feeling as I stand in rubber boots in a sloshing tide, searching for a healthy starfish. How can one address the hard questions of a storm-threatened time: What should I do? Who should I be? How can one celebrate and love this glittering world, even as it becomes a sickened and dangerous thing? What can be said in response to the arrogance and illogic of those who would wreck the world? What are the words to say to people who deeply care, words that will help them move forward with new joy, courage, and integrity? How did human decisions create the climate emergencies, and how might new thinking take advantage of this last chance for civilization to start again and get it right this time? And this most important question: How can people come together in the one thing that has the power to change history—a great rising wave of moral outrage at the plunder and the wreckage, and an affirmation of a better way?

Because the looming environmental emergencies present a moral crisis, they call the citizens of the world to our best and highest humanity. **Climate change is a violation of human rights on an unimaginable scale.** It is a failure of reverence for all the lives—the creatures of land and sea that are striving to continue. It is a violation of justice, casting the burdens of corporate profligacy on those who will never enjoy its benefits. It is a betrayal of the children. It is also a chance, perhaps a last chance, to redeem the promise of humanity, the evolved awareness in a soft body that, from the time it draws its first breath, seeks to love and be loved.

Because they are a moral crisis, global warming and extinction are also a crisis of the imagination. The world can't fight its way out of this. **We have to think our way out.** This will require as great an exercise of the human imagination as the world has ever seen. The clever minds of the hominid will have to reinvent not just light-bulbs and electric cars. Rather, we will have to reinvent ourselves, we humans, thinking in entirely new ways about who we are and how we will preserve the best of our humanity as the world in which we evolved becomes something else entirely.

Finally, climate change is a crisis of character. We people of this decade, by some terrible chance, are the ones who are witness to the end of one world and the beginning of another. Maybe none of us would have chosen this time to be alive. The decisions we make in the next few years will decide if we will, or will not, redeem a just and thriving planet. As the world we know goes away, we are called to courage, not only to face down the coal trains and corporate bullies but to face into the wind, to keep moving forward on a course that has no predictable destination, across waters with hidden, changing shoals. We are called to integrity, to do what we believe is right, even if it has little prospect of success. And we are called to love—fiercely, maybe futilely, acting always in defense of what we love too much to lose.

AS THE TIDE runs out, past the blue mussels to the great slabs of kelp, my grandson walks the high-tide line, looking for treasures. The tide has rolled a many-stranded rope from kelp stipes, eelgrass, gulls' wings, clamshells—whatever the sea has carried. He brings me a shiny green stone and a deer's femur, and then something I have never seen before.

It's a chalky white disk, as light and patterned as if it had been tatted. From a central disk about the size of a quarter, raised ridges radiate out like petals and then abruptly stop. I turn it over in my hand. In fact, the whole thing is about the size of my hand, and there are twenty-one of those ridges. Clearly organic. Radially symmetrical. Beautiful as a bone. The lacy exoskeleton of some astonishing new creature? My grandson touches it to his cheek. Then I know what it is, and I have to sit down on the sand.

This is the sun-dried central disk of a giant sunflower sea star (*Pycnopodia helianthoides*) after its twenty-one legs have broken off and crawled away to die, killed by starfish wasting disease. What a glorious creature, I think but do not say, to have

died such a death. What an improbable creature it once was. Goopy and heavy, sometimes a meter across, stubbled with spines like the gray chin of an ancient man, the sunflower sea star creeps after prey on 128,000 tube feet, slithering maybe a meter every minute. When one is stressed, it can shed its legs, a process that emits a chemical that warns of danger. How shimmering with menace the very sea-water must have been on the day this creature died.

It is important to say this: There are many things worth saving. No matter what happens, there are many things worth saving. The Earth is filled, it is populated, it is shivering, with lives of beauty and astonishment—what a child's hand holds, and the hand itself, and the reverence in the hand's careful holding. The fate of these lives is not a matter of indifference or of economic expediency alone. These lives are the irreplaceable, priceless consequence of the creativity of the universe over fourteen billion years. Now that humans have taken on the role of Earth-changer, we take on as well the responsibilities of celebration, protection, and ferocious love.

Kathleen Dean Moore Chichagof Island, Alaska 2014

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from "Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist" by Kate Raworth

"Imagine, then, if ours could be the turnaround generation that started putting humanity on track for that future. What if we each were to mentally map our own lives on to the Doughnut, asking ourselves: how does the way that I shop, eat, travel, earn a living, bank, vote and volunteer affect my personal impact on social and planetary boundaries? What if every company strategised around a Doughnut table, asking itself: is our brand a Doughnut brand, whose core business helps to bring humanity into that safe and just space? Imagine if the G20 finance ministers—representing the world's most powerful economies—met around a Doughnut-shaped conference table to discuss how to design a global financial system that served to bring humanity into that sweet spot. These would be world-changing conversations."

[this may be a repeat, clearly a good idea]

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Ursula Le Guin [don't know where this quote is from]

Is a yin utopia a contradiction in terms, since all the familiar utopias rely on control to make them work, and yin does not control? Yet it is a great power. How does it work? I can only guess. My guess is that the kind of thinking we are, at last, beginning to do about how to change the goals of human domination and unlimited growth to those of human adaptability and long-term survival is a shift from yang to yin, and so involves acceptance of impermanence and imperfection, a patience with uncertainty and the makeshift, a friendship with water, darkness, and the earth.

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Out of the Wreckage: A New Politics for an Age of Crisis (English Edition) George Monbiot

The Longing for Belonging

We are extraordinary creatures, whose capacity for altruism and reciprocity is unmatched in the animal kingdom. But these remarkable traits have been suppressed by an ideology of extreme individualism and competition. With the help of this ideology, and the story used to project it, alienation and loneliness have become the defining conditions of our time. Far from apprehending them as threats to our well-being, we have been induced to see them as aspirations.

As a result, we find it hard to imagine our way out of the reaction and helplessness to which we have succumbed. We struggle to recognise, let alone resolve, our common problems. This has frustrated our potential to do what humans do best: to see a threat to one as a threat to all; to find common ground in confronting our predicaments; and to unite to overcome them.

To escape from this trap, we first need to perceive it. We need to name the power that has exacerbated our isolation and our collective loss of agency. This power is neoliberalism, the story it tells and the political programmes that arise from it.

Our failure to tell a new story with which to replace it has allowed this power to persist and grow. By confronting the politics of alienation with a politics of belonging, we rekindle our imagination and discover our power to act.

The Wisdom of Crowds

Some of these proposals may sound like impossible dreams. But in Chapter 9 I explored the means by which they might be realised. Organising self-motivated networks of volunteers, using the wisdom of crowds to refine and enhance new political techniques, we mobilise a force that the power of money can never match: mutual aid, operating on a grand scale. In combination with new strategies for reaching and persuading politicians, there may be nothing within the scope of democratic politics that this method cannot achieve, nothing that it cannot change.

Coming Home to Ourselves

Through restoring community, renewing civic life and claiming our place in the world, we build a society in which our extraordinary nature –our altruism, empathy and deep connection –is released.

When we emerge from the age of loneliness and alienation, from an obsession with competition and extreme individualism, from the worship of image and celebrity and power and wealth, we will find a person waiting for us. It is a person better than we might have imagined, whose real character has been suppressed. It is the one who lives inside us, who has been there all along.

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Doughnut Economics by Kate Raworth

Here's the nub of it: Regenerative industrial design can only be fully realised if it is underpinned by regenerative economic design. . . . and that is currently sorely missing. Making it happen calls for rebalancing the roles of the market, the commons and the state. It calls for redefining the purpose of business and the functions of finance. And it calls for metrics that recognise and reward regenerative success. Taking on this redesign task is surely one of the most exciting opportunities for twenty-first-century economists. And—as you would expect in a complex, evolving economy—it is a redesign process that will emerge not from textbook theories, but from the innovative experiments of those who are trying to bring it about.

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Sam Muirhead, one of the instigators of the Open Source Circular Economy movement, believes that circular manufacturing must ultimately be open source because the principles behind open-source design are the strongest fit for the circular economy's needs. These principles include: modularity (making products with parts that are easy to assemble, disassemble and rearrange); open standards (designing components to a common shape and size); open source (full information on the composition of materials and how to use them); and open data (documenting the location and availability of materials). In all this, transparency is key. 'For whoever has the product at the end of its use, the recipe should be open source so anyone can see how to reuse its materials,' Muirhead told me. And since that open recipe allows anyone to improve or adapt the product to their needs, 'It means you have a distributed R& D team around the world made up of expert users such as local repair shops, customization specialists, and innovative designers. These principles give rise to a set of circular business models that work not despite being open source but because they are open source.'

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from "Design as Future-Making" by Bloomsbury, Susan Yelavich, Barbara Adams

"RETURNING DUCHAMP'S URINAL TO THE BATHROOM? ON THE RECONNECTION OF ARTISTIC EXPERIMENTATION, SOCIAL RESPONSIBILITY, AND INSTITUTIONAL TRANSFORMATION
Teddy Cruz

It is obvious by now that the celebrated metropolitan explosion in the years of the last economic boom also produced in tandem a dramatic project of marginalization, resulting in the unprecedented growth of slums surrounding major urban centers, exacerbating the socioeconomic and demographic conflicts of uneven urbanization and putting urban asymmetry at the center of today's crises. In the context of this shift, the design professions are paralyzed, silently witnessing the consolidation of the most blatant politics of unaccountability, the shrinkage of social and public institutions, and the absence of a single proposal or action that might suggest a different approach or different arrangements. Rather than an economic and environmental crisis, ours is

primarily a cultural crisis resulting in the inability of institutions to question their ways of thinking, their exclusionary policies, the rigidity of their protocols, and silos. Within this radical context we must question the role of architectural research and design today.

The primary site of artistic intervention for research and design today is the gap between cultural institutions and the public—a space now instigating a new civic imagination and collective political will. It is not enough to give art the task of only revealing metaphorically the socioeconomic histories and injustices that produced these crises, but **it is essential that art becomes an instrument to construct specific procedures to transcend them and develop a more functional set of operations that can reconnect art and architecture to the urgency of the everyday and to a rethinking of its institutions.** The formation of new platforms of engagement in the creative fields can only be made possible with a sense of urgency, pushing us to rethink our very procedures. The need for expanded modes of artistic practice, alternative sites of research and pedagogy, new conceptions of cultural and economic production, and the reorganization of social relations seem more urgent than ever.”

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from "Speculative Everything: Design, Fiction, and Social Dreaming (The MIT Press)" by Anthony Dunne, Fiona Raby

"But we are optimistic. Triggered by the financial crash of 2008, there has been a new wave of interest in thinking about alternatives to the current system. And although no new forms of capitalism have emerged yet, there is a growing desire for other ways of managing our economic lives and the relationship among state, market, citizen, and consumer. This dissatisfaction with existing models coupled with new forms of bottom-up democracy enhanced by social media make this a perfect time to revisit our social dreams and ideals and design's role in facilitating alternative visions rather than defining them. Of being a catalyst rather than a source of visions. It is impossible to continue with the methodology employed by the visionary designers of the 1960s and 1970s. We live in a very different world now but we can reconnect with that spirit and develop new methods appropriate for today's world and once again begin to dream. But to do this, we need more pluralism in design, not of style but of ideology and values."

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Archer, David. The Long Thaw: How Humans Are Changing the Next 100,000 Years of Earth's Climate (Princeton Science Library) (pp. 173-174). Princeton University Press. Kindle Edition.

Ethics and fairness are a lot to ask of the political process, especially when most of the people affected by the decision, people of the distant future, do not have a voice in the decision.

We will conclude by considering the awesome potential energy impacts of a gallon of gasoline on Earth. When it is burned, it yields about 2500 kilocalories of energy, but this is just the beginning. Its carbon is released as CO₂ to the atmosphere, trapping Earth's radiant energy by absorbing infrared radiation. About three-quarters of the CO₂ will go away in a few centuries, but the rest will remain in the atmosphere for thousands of years.

If we add up the total amount of energy trapped by the CO₂ from the gallon of gas over its atmospheric lifetime, we find that our gallon of gasoline ultimately traps one hundred billion (100,000,000,000) kilocalories of useless and unwanted greenhouse heat. The bad energy from burning that gallon ultimately outweighs the good energy by a factor of about 40 million.

The enormous world-altering potential of that gallon of gasoline has taken the reins of Earth's climate away from its natural stabilizing feedback systems, and given them to us. May we use our newfound powers wisely.

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From DESIGNING ENERGY SOLUTIONS. 17Dec2018

Reduce Electricity Demand in the Buildings and Industry Sectors

Demand for electricity is driven by buildings and industry, and increasing their efficiency is a large-scale, cost-effective strategy. Efficiency is typically the most cost-effective way of reducing emissions, with initial investments paying dividends for years via reduced fuel costs.

Reduce the Carbon Intensity of Electricity Generation

Electricity sector emissions can also be lowered by reducing the carbon intensity of electricity generation. Using fossil-free technologies such as wind, solar, hydro, geothermal, and nuclear to generate electricity can avoid the emissions (and also the air quality problems) that come from burning fossil fuels such as coal and natural gas.

Reduce Transportation Emissions Through Efficiency, Electrification, and Urban Mobility

The transportation sector is a large and growing source of greenhouse gas emissions. The top ways to reduce pollution from transportation are to improve vehicle fuel economy, electrify vehicles (and to simultaneously reduce the carbon intensity of electricity generation), and provide alternatives to personal vehicle travel via smart urban planning and public transit.

Reduce Non-Electricity Industry Sector Emissions

Non-electricity industry sector emissions are another large source of greenhouse gas emissions. These include primarily industrial process emissions (e.g., the chemical processes involved in cement manufacturing or natural gas venting and flaring) but also energy used for heat, as in the iron and steel industry.

Reduce Deforestation and Forest Degradation in Tropical Forest Nations

In tropical forest nations where a large share of emissions come from land use, land use change, and forestry, policymakers should aim to reduce deforestation and forest degradation. A handful of options exist to achieve these goals, including legally protecting forests through the creation of designated protected areas, payments to landowners for providing ecosystem services, and payments to landowners to remove forested land from timber production.

Although land use is an important sector for emission reductions, this website and book focus on energy and industrial process emission reductions. The science, the policies, and the actors for reducing emissions from land use are very different from those for energy and industrial processes, and they deserve separate treatment from experts in land use policy.

Conclusion

The Paris Agreement targets, if fully achieved, get us about one-third of the way to the two-degree goal, meaning further reductions will be necessary. But more important, the commitments under the Paris Agreement are targets, and unless they are converted into highly effective, sector-specific national policies, they will achieve little. The aim of this book is to help guide that process.

The starting point is to evaluate where emissions are coming from. Energy and industrial processes are the dominant sources of greenhouse gas emissions in most economies. Within the energy sector, emissions are evenly spread across the electricity, industry, transportation, and building sectors. This assessment suggests that to reduce emissions, policymakers need to focus on reducing electricity demand in the industry and building sectors, reducing the carbon intensity of electricity generation, improving the efficiency of vehicles while providing cleaner alternatives, and reducing process emissions in the industry sector. In certain economies, a strong focus on reducing emissions from land use change is also necessary.

Now that we know what we need to do reduce emissions, the next question is: How do we achieve these goals? To examine this question, we turn next to the four essential types of energy policy.

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Lertzman. Hitting the Reset Button essay.

We would be focused on messaging according to empathy for these “Three As” – Anxiety, Ambivalence and Aspiration

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Reflections on Climate Change Communication Research and Practice in the Second Decade of the 21st Century: What More Is There to Say?

Susanne C. Moser, Susanne Moser Research & Consulting, Santa Cruz, CA and Woods Institute for the Environment, Stanford University, Palo Alto, CA, USA; email: promundi [at] susannemoser.com

Abstract

Appreciable advances have been made in recent years in raising climate change awareness and enhancing support for climate and energy policies. There also has been considerable progress in understanding of how to effectively communicate climate change. This progress raises questions about the future directions of communication research and practice. What more is there to say? Through a selective literature review, focused on contributions since a similar stock-taking exercise in 2010¹, the paper delineates significant advances, emerging trends and topics, and tries to chart critical needs and opportunities going forward. It describes the climate communication landscape midway through the second decade of the 21st century to contextualize the challenges faced by climate change communication as a scientific field. Despite the important progress made on key scientific challenges laid out in 2010, persistent challenges remain (superficial public understanding of climate change, transitioning from awareness and concern to action, communicating in deeply politicized and polarized environments, and dealing with the growing sense of overwhelm and hopelessness). In addition, new challenges and topics have emerged that communication researchers and practitioners now face. The paper reflects on the crucial need to improve the interaction between climate communication research and practice, and calls for dedicated science-practice boundary work focused on climate change communication. **A set of new charges to climate communicators and researchers are offered in hopes to move climate change communication to a new place – at once more humble yet also more ambitious than ever before, befitting to the crucial role it could play in the cultural work humanity faces with climate change.**

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While it is an important first step, as others have argued (e.g., Bostrom et al., 1994), to assess what the public's knowledge looks like in contrast to scientific determinations of what they need to know, the educational problem for achieving understanding extends far beyond that. We need to consider the terrain between lay and expert mental models and figure out what it takes to help learners traverse that terrain. This involves understanding the patterns in how people perceive and think about environmental issues [?] cognitive and perceptual assumptions or default patterns that are likely to impede understanding and the ability to act. Further, if we set educated action as opposed to inert knowledge as the bar for success, then the educational challenges are extensive. We need to help the public develop the ability to understand climate change but also the sensitivity to perceive opportunities that invite action and, subsequently, the inclination to act.

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Last paragraph

We believe that we don't yet know what is possible for helping the public understand global warming with optimal educational support or with purposeful collaboration between educators, scientists, and the many others working on the urgent problem of climate change. But this chapter offers some insights into a few key building blocks: understanding people's default cognitive patterns, recognizing their difficulties understanding complex systems, and developing their sensitivities, abilities, and inclinations to act in environmentally intelligent ways. It is imperative that we help the public become environmentally intelligent and learn to act with that intelligence, rather than just admonish people for not doing so. Dedicating ourselves to that effort inspires optimism that future generations will become "conversant with the language in which nature speaks to us," and that we will be able to admire sunsets with our children.

Moser book section by TBD

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Dilling Making Energy use easy essay in Moser/Dilling book
Making it easy: establishing energy efficiency and renewable energy as routine best practice Lisa Dilling University of ColoradoÀBoulder Barbara Farhar University of ColoradoÀBoulder

we discuss some of the reasons for Americans' high energy consumption and the disconnect between expressed wishes and consumption reality. We also show how seamlessly embedding energy efficiency and renewable energy into products and energy services is necessary if society wishes to reduce energy waste as well as greenhouse gas emissions. "Making it easy" for companies and households to use sustainable energy products and services is a critical element of a comprehensive strategy toward greater sustainability. "Making it easy" means investing the resources to make energy-saving and sustainable-energy choices routine through a variety of mechanisms, which we discuss below. If the use of efficiency and renewable energy is made routine, the time spent on potentially complex decisions can be lessened or avoided altogether. **Doing so would also make the communication task easier: insteccad of trying to persuade individuals one by one to purchase more efficient products and services (likely to be an inefficient and less successful endeavor), campaigns could be directed toward those who build, provide, or legislate efficient and renewables-based products and services.**

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Swiss 2000 Watt society document. Red cover iBooks

Sustainable development

Wasserkraft Kernbrennstoffe

The 2000-Watt Society stands for sustainable development: the concept takes into account all aspects of sustainability which includes the environment, the economy and society. Today's society should not live at the expense of future generations. The 2000-Watt Society builds on solidarity between different generations and cultures for the

purpose of long-term stable development and for the world to be able to live in harmony.

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CO2 output: One tonne per capita per year

A CO2 output of one tonne per capita per year is an achievable long-term goal for Switzerland. This limit corresponds to a consumption of around 500 watts of fossil fuels. If fossil fuel energy needs are reduced by the levels set out in the 2000-watt vision, the ambitious CO2 target can be achieved in the second half of this century. However, **this will require stringent adaptations of buildings, facilities, vehicles and equipment as well as a new understanding of energy services.** If we are unable to make materials more efficient, increase the level of energy efficiency and use resources selectively, then the 2000-Watt Society which we envision will never be anything more than a declaration of intent.

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Aspire to a sustainable world society

An environmentally sustainable equilibrium can only be established if a change in attitudes takes place around the world. Only when cities and countries start working together to form a sustainable world society with a shared consciousness of responsibility for this and future generations will we be able to successfully master the challenges of globalization and climate change.

Zürich – Kunming:

Shared efforts for a sustainable future

City of Zürich

Office for Urban Development

P.O. Box, 8022 Zürich, Switzerland Phone: +41 44 412 36 63

stadtentwicklung@zuerich.ch

Office for Environmental and Health Protection Service P.O. Box 3251, 8021 Zürich, Switzerland

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Key Lessons Learnt and their Discussion

In this section we will present the key findings extracted from the interview conducted by Dr Sea Rotmann in October 2013 with Roland Stulz, an expert for the 2000 Watt Society:

- Create awareness: Give it a name and a place and do lighthouse projects
- Use an all-embracing vision as underlying model and driver – don't worry when practical details are vague in the beginning
- Both approaches work: top-down and bottom-up
- Active pioneers are crucial
- A rather technical approach can make things easier at the start: Nobody is against better buildings and more efficient technology, really...

- Promote a future-oriented life style - don't look back to your grandparents (but learn from them, they often were great conservationists)
- Address the public with tailored information: What does it mean for your daily life and your lifestyle? Give tailored advice for concrete action and show examples of landmark persons and families
- Address different groups of people in their own particular language
- Not the efficiency of a single product (e.g. car) is the problem, but the question of the ever

increasing number of products used – rebound effect

- Interventions for behaviour change are not easy to address and to finance
- Construction sector is relatively easy: good knowledge exists, guidelines, regulations and recommendations work
- Don't compare apples and oranges when doing a benchmark between different municipalities (rural vs urban)
- The classic rational Homo economicus is not the right approach to change habitual behaviour of energy consumption

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Paper titled Human Scale

Human Scale Energy Services: Untangling a 'golden thread'

Lina I. Brand-Correa*, Julia Martin-Ortega, Julia K. Steinberger

ABSTRACT

Prioritising human well-being while avoiding further damage to the planet is a key challenge in the era of climate change. This paper examines the role of energy as an intermediary between climate change and socio- economic outcomes, with the ultimate goal of identifying ways of decoupling human well-being from energy use. Building on Max-Neef's "Human Scale Development" framework and conceptualisation of human needs, we propose a novel community-level participatory approach to identify connections between energy services on the one hand and human need satisfaction on the other. This approach then enables communities to collectively consider and propose alternative ways to provide energy services. We compare the outcomes and reflect on the process of two exploratory workshops, undertaken in an urban and a rural area in Medellín (Colombia). **Our results indicate that these communities view energy services as satisfiers of human needs, with significant differences between the communities.** Furthermore, our approach enables the communities to broaden the solution space of energy service provisioning possibilities, thus constituting a promising alternative to the top-down technocratic perspectives currently prevalent in research and policy. We argue that this type of bottom-up approach is necessary to address the complex sustainability challenge of living well within environmental limits.

FROM ARTICLE:

...energy use is the key intermediary between environmental impacts and socio-economic outcomes. The UN's former Secretary-General Ban Ki-Moon described this crucial role of energy, when he stated that "Energy is the 'Golden Thread' that connects economic growth, social equity and environmental sustainability".¹ The connection between energy and environmental sustainability is widely understood, and there is also a large body of literature concerned with the connection between energy and economic activity. However, the direct link between human well-being and energy use is much less studied.

We argue that the 'Golden Thread' that weaves through to human well-being is not energy (measured in physical units, e.g. kWh or joules), but rather energy services (for instance illumination, thermal comfort, mobility). Energy services, rather than energy itself, are what people demand [2], the benefits humans derive from energy carriers [3], what contributes to people's well-being [4]. This research aims to further investigate the connection between energy services and well-being, and to elicit bottom-up proposals of alternative energy service provision. These new proposals may inform the decoupling of energy use from human well-being, with the ultimate goal of achieving high levels of human well-being within planetary boundaries [5–7].

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" from "Timefulness: How Thinking Like a Geologist Can Help Save the World" by Marcia Bjornerud

"In other words, it is time for all the sciences to adopt a geologic respect for time and its capacity to transfigure, destroy, renew, amplify, erode, propagate, entwine, innovate, and exterminate. Fathoming deep time is arguably geology's single greatest contribution to humanity. Just as the microscope and telescope extended our vision into spatial realms once too minuscule or too immense for us to see, geology provides a lens through which we can witness time in a way that transcends the limits of our human experiences.

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A MATTER OF TIME

While we humans may never completely stop worrying about time and learn to love it (to borrow a turn of phrase from Dr. Strangelove), perhaps we can find some middle ground between chronophobia and chronophilia, and develop the habit of timefulness—a clear-eyed view of our place in Time, both the past that came long before us and the future that will elapse without us.

Timefulness includes a feeling for distances and proximities in the geography of deep time. Focusing simply on the age of the Earth is like describing a symphony in terms of its total measure count. Without time, a symphony is a heap of sounds; the durations of notes and recurrence of themes give it shape. Similarly, the grandeur of Earth's story lies in the gradually unfolding, interwoven rhythms of its many movements, with short motifs scampering over tones that resonate across the entire span of the planet's

history. We are learning that the tempo of many geologic processes is not quite as larghissimo as once thought; mountains grow at rates that can now be measured in real time, and the quickening pace of the climate system is surprising even those who have studied it for decades.

Still, I am comforted by the knowledge that we live on a very old, durable planet, not an immature, untested, and possibly fragile one. And my daily experience as an earthling is enriched by an awareness of the lingering presence of so many previous versions and denizens of this place. Understanding the reasons for the morphology of a particular landscape is similar to the rush of insight one has upon learning the etymology of an ordinary word. A window is opened, illuminating a distant yet recognizable past—almost like remembering something long forgotten. This enchants the world with layers of meaning and changes the way we perceive our place in it. Although we may fervently wish to deny time for reasons of vanity, existential angst, or intellectual snobbery, we diminish ourselves by denouncing our temporality. Bewitching as the fantasy of timelessness may be, there is far deeper and more mysterious beauty in timefulness.

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from "Liberation Science: Putting Science to Work for Social and Environmental Justice" by Steven H. Emerman, Marcia Bjørnerud, Jill S. Schneiderman, Sarah A. Levy

In the chapters that follow, I hope to convey the mind-altering sense of time and planetary evolution that permeates geologic thinking. It may not be possible to grasp fully the immensity of geologic time, but one can at least develop some feeling for its proportions. I once had a math professor who was fond of reminding the class that “there are many sizes and shapes of infinity.” Something similar can be said about geologic time, which though not actually infinite is effectively so from a human perspective.

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From the Introduction Chapter to the book LIBERATION SCIENCE: PUTTING SCIENCE TO WORK FOR SOCIAL AND ENVIRONMENTAL JUSTICE:

"The final part, “Rediscovering the Commons: Philosophical Principles for Global Environmental Justice,” includes two essays that propose radical (and radically different) changes in the paradigms for global environmental thinking. In “Buddhist Living in the Anthropocene,” geologist Jill Schneiderman argues that the scientific practice of “divorcing head from heart” is unnatural and undesirable and that there should be a place in scientific discussions of environmental issues for the principles of ethical conduct, especially as articulated in Buddhist teachings. In “Geomimicry for Social and Environmental Justice,” Marcia Bjørnerud, also a geologist, proposes that environmental wrongs and social injustices are both rooted in a distorted perception of the relationship between humans and the natural world. She suggests that Earth’s own history provides both practical and philosophical lessons about building stable and

durable systems and that our collective well-being depends on respecting and emulating geologic laws rather than trying to evade them."

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SUSTAINABLE ENERGY with the hot air book

What I'm aiming to do in this book is to make these numbers simple and memorable; to show you how you can figure out the numbers for yourself; and to make the situation so clear that any thinking reader will be able to draw striking conclusions. I don't want to feed you my own conclusions. Convictions are stronger if they are self-generated, rather than taught. Understanding is a creative process. When you've read this book I hope you'll have reinforced the confidence that you can figure anything out.

I'd like to emphasize that the calculations we will do are deliberately imprecise. *Simplification is a key to understanding. First, by rounding the numbers, we can make them easier to remember. Second, rounded numbers allow quick calculations.*

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From Tina Groetzer chapter.. Learning Causality in a Complex World: Understandings of Consequences [Blue Fire Reader Book]

another non-obvious cause → particulate matter associated with smog that alters the refractive angle of sunlight. Particulate matter is not easily visible with the naked eye and so it is not usually accounted for as a cause of brilliant sunsets. Greenhouse gases pose an even greater challenge because the causes and the outcomes (at least at this stage) are difficult to detect without long-term attention to patterns and careful measurements. The combination of spatial gaps, temporal delays, and non-obvious causes makes it all too easy to ignore the causes of global warming.

The temporal aspects of global warming are difficult for other reasons as well. In order to realize that global warming is occurring, we need to be able to track patterns over time. People are not necessarily good at reasoning about patterns over time, and too often extrapolate from the moment (Dorner, 1989). They typically do understand systems that involve simple accumulation, for instance, increasing trash in landfills, or → more visible to the general population → along highways. However, once complications are introduced such as exponential growth or variations in rate of change, people find it harder to track the patterns. Positive feedback loops, where one event triggers other events that increase the cause of the initial event, introduce further complexity into rates of change. For examples, global warming causes

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**From THE GLOBE Why don't we care about climate change?
Ignorance and selfishness aren't the reasons we face environmental catastrophe – it's the way our ancient brains calculate risk and reward. Learning to accept that may help save us Published December 21, 2018
Dan Gardner is the author of Risk: The Science and Politics of Fear**

Climate-change researchers are exploring a wide range of interventions designed to speak to System 1. The most promising involves shrinking psychological distance by replacing “distant” abstractions with concrete, here-and-now words and images. That means replacing an abstraction such as “rising ocean levels” with an image of Prince Edward Island’s coastline when the iconic red beaches have been swallowed. In place of “future generations,” describe a person with a face, name and story. Instead of “the economy” and “global temperatures,” describe her hunger and the sweltering heat.

Done well, the remote threat becomes as concrete – as detailed, vivid and visceral – as a lion crouching at the edge of the long grass, her muscles tense, her stare relentless. There’s nothing new about this, of course. But that’s the point. Good storytellers have been shrinking psychological distance since the days when stories were told around campfires and System 1 was evolving to help us make sense of the world.

People cannot feel dangers measured in atmospheric concentrations of a gas so common we exhale it.

But we can feel lions. We just have to see them.

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Nikiforuk, Andrew. The Energy of Slaves: Oil and the New Servitude (pp. 131-132). Greystone Books. Kindle Edition.

THE ENERGY OF SLAVES book EONCKICS Chapter

As oil greased the U.S. economy and then the global marketplace, economics morphed into a narcissistic endeavor that sought to turn an awkward social science into “the physics of society.” In so doing, it made humans the master class. **At the same time, it omitted energy from its models and dropped any mention of finite resources.** It embraced markets and the flow of capital as the sole determinants of life. Even Marx and Engels, astute but often hyperbolic critics of capitalism, couldn’t believe the proliferation of capital unleashed in the nineteenth century: “The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together.”

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Nikiforuk, Andrew. The Energy of Slaves: Oil and the New Servitude (p. 157). Greystone Books. Kindle Edition.

The Energy of Slaves: Oil and the New Servitude

Since the 1950s, study after study has shown that when nations spend oil, their GDP rises; when oil prices rise, their GDP falls. The International Energy Agency calculates that every 1 percent increase in GDP requires a .3 percent increase in primary oil demand. **The modern economy, says Swedish economist Kjell Aleklett, motors along: it simply won’t run without oil.** The implications, say Aleklett and the Uppsala Hydrocarbon Depletion Study Group, are obvious to everyone except modern economists: “We can now conclude that future growth in GDP must be dependent upon

fuels other than oil if it is to continue as expected. This, in turn, defines the beginning of the end of the 'Oil Age,' and society will have to seek other driving forces for future GDP growth.”

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In a 2008 paper for the OECD, Swedish physicist Kjell Aleklett warned political leaders that the continent's economic stagnation and debt levels will grow worse as fossil-fuel liquids grow more expensive. (Like the United States, Europe now transfers \$1 billion of its wealth every day to oil companies and petrostates.) “We have climbed high on the 'Oil Ladder' and yet we must descend one way or another. It may be too late for a gentle descent, but,” Aleklett writes, “there may still be time to build a thick crash mat to cushion the fall.”

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WITH BOTH EYES OPEN book. <http://www.withbotheyesopen.com/read.php>

Uncertainty

If only CO2 were coloured pink, toxic releases were noisy and resource depletion caused a light to flash. It would be very much easier to address concerns about sustainable materials if all the drivers of harm and their long term impacts were instantly visible. But for most environmental processes there's a time delay between cause and effect and anyway our understanding of the causes is only partial. Here are the main uncertainties we face in exploring the impact that materials have on future sustainability:

- We do not fully understand how human activity now will affect the environment in the future.
- We do not fully understand how future environmental conditions will affect human and other life.
- We do not fully understand the environmental consequences of changes in human activity.

Specifically with regard to our five key materials, we face several other uncertainties that limit our ability to predict the consequences of future materials processing:

- We don't know how the world population will evolve or how rich we will be in future, so we don't know how demand for materials will develop or how it will be affected by environmental pressures.
- **Although we have good understanding of emissions released from industrial processes and fuel combustion, we don't have a clear picture of all the uses of electricity associated with materials processing, which indirectly drives emissions.**
- We don't have perfect data on the current end-uses of the key materials, because no one collects it, nor do we have good data on existing stocks of materials in use that might be re-used, recycled or replaced in the future.

- We don't know how costs will evolve, for example as oil becomes more scarce, less pure reserves of iron ore are used for normal production, or if more electricity is in future generated by renewables.

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Ken Caldiera MIT Magazine STOP EMISSIONS Nov 2015

The agreements made in Paris will be helpful, but they're like changing over to compact fluorescent lightbulbs: nice, but **insufficient to the scale of the task**. However, the attention brought to the climate problem at the highest levels of government represents an important step toward a social tipping point—to that phase change when we decide collectively that we are not going to use the sky as a waste dump.

Our children's children will look back on us and ask: "How could everyone have continued using the sky as a waste dump even after everyone knew?" Let's hope they can add, "Well, at least everybody woke up and stopped doing it."

So we need to plan ahead using estimates, making sure we're clear about the uncertainty in them, but not using uncertainty as an excuse for inaction. How do we make good estimates?

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from "Ecocriticism on the Edge: The Anthropocene as a Threshold Concept" by Timothy Clark

Artistic work that attempts to convey the Anthropocene at its most counter-intuitive has the challenge of somehow mapping it onto those topics and psychological and cognitive structures that constitute the 'interesting' –not just for a small number of critical specialists, but for most human beings –for art and literature are nothing without a significant audience. Yet, as a source of profound emotional engagement –even for those specialists –how feasible is such a remapping? *Or is the goal of instilling a widespread, deeply internalized and consequential engagement with the Anthropocene through cultural artefacts as hopeless as, say, trying to represent to a chimp the workings of mathematical calculus through the varying patterns with which hidden or offered peanuts are made available?*

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Even with a focus on such spectacular insects, readers' imaginations **are still so much more easily engaged and drawn in by the human drama, with its humour, suspense, love interest and psychological identification**, than by the environmental one, concerned with insect behaviour, largely invisible ecological and population dynamics, climate projections and slow-motion ecocide. **Is the human imagination**

really so depressingly enclosed, able to be captivated only by immediate images of itself? In so complex a context as the Anthropocene, narrative closure of the kind achieved in Kingsolver's novel will always risk being evasive. One could argue that, in fact, a pointed disjunction between the individual character's story and the fate of the insects would have made the text more provocative as a climate change novel. Personal success would then have been presented against the discordant backdrop of a degrading biosphere. Alternatively, the survival of the butterflies could have been juxtaposed with some personal defeat or resignation. **There is a case to be made that the psychology of narrative –of what makes for people a credible or compelling story –is itself a problem for representations of the Anthropocene with its plethora of Level III events.** George Marshall's study of climate change denial takes up the question. In a striking experiment, Marshall describes how both environmental campaigners and climate change deniers often deploy an exactly identical 'archetypal' narrative structure when making their cases, with only the placeholders varying according to their respective convictions. Marshall writes: This experiment provides strong clues about what makes a compelling narrative –cause, effect, a perpetrator, and a motive (ideally one that is consistent with our assumptions about how we believe they might act). The most compelling narratives in climate change have this structure: Governments (perpetrators) justify carbon taxes (effect) in order to extend their control over our lives (motive). Right-wing oil billionaires (perpetrators) fund climate change denial (effect) to increase their wealth (motive).⁴ Seemingly compelling stories about the real state of the world may need to be treated with caution as to the source of their compulsion. Awareness of these narrative structures, as one reads or listens to debates, can turn what present themselves as arguments into the moves of zombie choreography. Marshall also observes that Christopher Booker, a theorist of narrative and author of *The Seven Basic Plots: Why We Tell Stories* (2004),⁵ is also a leading climate change denier who has written several books for that cause, even losing a case for libel against Rajendra Pachauri, then head of the UN's Intergovernmental Panel on Climate Change (IPCC).⁶ Marshall's point seems to be that a strong sense of how narratives work will make someone sceptical of some dominant stories about climate change, for they seem to fit so well the templates of a psychological formalism.

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Trexler is not really describing an innovation in the novel form per se: he is describing a mode of critical reading newly sensitized by the demands of the Anthropocene, one become suspicious of readings that give exclusive primacy to pre-given psychological motives as agents of the plot. This new mode of reading is not exclusive to accounts of climate change fiction –the reading of Raymond Carver given earlier, for example, also pivots around nonhuman agency, in that case material infrastructure. A strength of Trexler's study of climate fiction, as it traces the various failings, fallings-short and hard-won successes in representations of the Anthropocene, is that this tracing also draws a strong picture, implicit but omnipresent, of those norms of response, interest and engagement that need to be overcome. In literary representations of the Anthropocene the techniques available to engage a reader's immediate emotional

interest emerge as most often at odds with the scale, complexity and the multiple and nonhuman contexts involved. Thus politically engaged novels and films almost always dramatize the issues in the form of a confrontation or conflict between the stance of characters with opposing views, so that a reader's or viewer's engagement with intellectual debate tends to become eclipsed by familiar modes of suspense and identification, which usually have more to do with the human psychology of competition or self-fulfilment (as in Dellarobia's case) than with the true complexities of the issue. The major question raised here, and by consideration of Kingsolver's novel, is suggested at the beginning of this chapter: are the limits of readers' engagement being encountered merely those of now dated cultural and artistic conventions capable of change and reinvention? Or does the challenge of representing major ecological issues mean acknowledging the limits of the human capacity for engagement beyond certain scales in space or time, and beyond the spheres of immediate identification or empathy? This limit could be inexorable, just as we have no choice in our day-to-day interactions with each other but to let 'folk psychology', the immediate conception of oneself and others as autonomous, intention-directed 'persons', override the viewpoint of naturalistic science, even while knowing our norm of personhood to be a kind of pragmatic fiction.

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More from EcoCriticism book

Get this book: Allenby, B. R. and Sarewitz, D. (2011), *The Techno-Human Condition*, Cambridge, MA: MIT Press.

Book:

Sense of Place and Sense of Planet; The Environmental Imagination of the Global

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ON THE FUTURE: PROSPECTS FOR HUMANITY Martin Rees

despite these hugely stretched conceptual horizons—and despite our enhanced understanding of the natural world, and control over it—the timescale on which we can sensibly plan, or make confident forecasts, has become shorter rather than longer.

Europe's Middle Ages were turbulent and uncertain times. But these times played out against a 'backdrop' that changed little from one generation to the next; devotedly, medieval masons added bricks to cathedrals that would take a century to finish. But for us, unlike for them, the next century will be drastically different from the present. There has been an explosive disjunction between the ever-shortening timescales of social and technical change and the billion-year time-spans of biology, geology, and

Although we live under the shadow of unfamiliar and potentially catastrophic hazards, there seems to be no scientific impediment to achieving a sustainable and secure world, where all enjoy a lifestyle better than those in the 'West' do today. We can be technological optimists, even though the balance of effort in technology needs redirection. Risks can be minimised by a culture of 'responsible innovation', especially in fields like biotech, advanced AI, and geoengineering, and by reprioritising the thrust

of the world's technological effort. We should remain upbeat about science and technology—we shouldn't put the brakes on progress. Doctrinaire application of the 'precautionary principle' has a manifest downside. Coping with global threats requires more technology—but guided by social science and ethics.

Chapter 7. Lewis Dartnell, *The Knowledge: How to Rebuild Our World from Scratch* (New York: Penguin, 2015). Books such as this are educative. It's surely regrettable that so many of us are ignorant of the basic technologies we depend on.

many of the challenges—for instance, planning how to meet the world's energy needs while avoiding dangerous climate change, and ensuring food-source security for nine billion people without jeopardising a sustainable environment—involve multidecade timescales that are plainly far outside the 'comfort zone' of most politicians. There's an institutional failure to plan long-term and to plan globally.

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Metamagical Themas: Questing For The Essence Of Mind And Pattern BY DOUGLAS HOFSTADER

It is fashionable for people to decry the appalling illiteracy of this generation, particularly its supposed inability to write grammatical English. But what of the appalling innumeracy of most people, old and young, when it comes to making sense of the numbers that, in point of fact, and whether they like it or not, run their lives?

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The world is gigantic, no question about it. There are a lot of people, a lot of needs, and it all adds up to a certain degree of incomprehensibility. But that is no excuse for not being able to understand—or even relate to—numbers whose purpose is to summarize in a few symbols some salient aspects of those huge realities. Most likely the readers of this article are not the ones I am worried about. It is nonetheless certain that every reader of this article knows many people who are ill at ease with large numbers of the sort that appear in our government's budget, in the gross national product, corporation budgets, and so on. To people whose minds go blank when they hear something ending in "illion", all big numbers are the same, so that exponential explosions make no difference. Such an inability to relate to large numbers is clearly bad for society. It leads people to ignore big issues on the grounds that they are incomprehensible. The way I see it, therefore, anything that can be done to correct the rampant innumeracy of our society is well worth doing.

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What most people truly don't appreciate is that making such a guess is very much the same as looking at the chairs in a room and guessing quickly if there are two or seven or fifteen. It is just that here, what we are guessing at is the number of zeros in a numeral, that is, the logarithm (to the base 10) of the number. If we can develop a sense for the number of chairs in a room, why not as good a sense for the number of zeros in a numeral? That is the basic premise of this article.

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Blessed Unrest: How the Largest Social Movement in History Is Restoring Grace, Justice, and Beauty to the World BY PAUL HAWKIN

One quadrillion cells make up a human being, and 90 percent of them are bacteria, fungi, yeasts, and other microbes, without which we could not survive. Therein lies a paradox: what makes us fully human is, well, not human. The prospect that we descended from lower primates, anathema to Christian fundamentalists, is a relatively minor phenomenon in the larger picture of science. Within our body is the back-story of the earth four billion years ago, the molecular chains, elemental compounds, simple bacteria, and salty fluids that wash our eyes and surround our cells, forming a compendium of life that has preceded us. We have always been a work in progress, a cumulative animal, a chimeric fusion of different organisms from the beginning of life “bound together by the elastic string of time.”⁴ It is thought that our microbial ancestors came into being when a soupçon of carbon polymers, nucleotides, and amino acids combined over a sulfurous oceanic vent. It was a preternatural event, if ever there was one: a living cell made of inanimate compounds.

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Ecology is about how living organisms interact with one another and their environment. **Sustainability is about stabilizing the currently disruptive relationship between earth’s two most complex systems—human culture and the living world. The interrelation between these two systems marks every person’s existence and is responsible for the rise and fall of every civilization.**

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Goleman ECOLOGICAL INTELLIGENCE Teachers Guide

Chapter 1 — The Hidden Price of What We Buy Chapter 1 — The Hidden Price of What We Buy Synopsis: Synopsis: Goleman gives examples of the far-reaching environmental, health, and social effects of things we buy. He introduces the term “ecological intelligence” and suggests that people could make a positive impact through their consumer choices.

Chapter 2 — “Green” Is a Mirage Chapter 2 — “Green” Is a Mirage Synopsis: Synopsis: Using specific examples like a recycled glass jar, a cloth shopping bag, and an organic tshirt, Goleman shows how even things we may think of as “green” can have serious environmental and social impacts. He points out that green is a relative term, not an end result, and that life cycle assessment (LCA) is one way to learn about all the inputs and outputs involved in a particular product.

Chapter 3 — What We Don’t Know Synopsis: Synopsis: Goleman describes how the structure of human brains, which evolved to detect certain kinds of threats, makes it difficult for us to see and react to current problems that affect our health and environment. social impacts. He points out that green is a relative term, not an end

result, and that life cycle assessment (LCA) is one way to learn about all the inputs and outputs involved in a particular product.

Chapter 4 — Ecological Intelligence Chapter 4 — Ecological Intelligence Synopsis: Synopsis: Goleman explains that while **nature operates at different scales—from the micro to the global—humans tend to perceive only one scale at a time, a tendency that underlies many of our current environmental problems.** He suggests that through collective information gathering and processing, ecological intelligence will help us move beyond this limitation.

Chapter 5 — The New Math Synopsis: Synopsis: Goleman points out that measures like carbon footprint only provide part of the story about a product's impacts and that they can themselves cause unintended consequences. He suggests that we need to understand an item's impact in three different realms: **the geosphere, the biosphere, and the sociosphere.**

Chapter 6 — The Information Gap Chapter 6 — The Information Gap Synopsis: Synopsis: In this chapter, Goleman examines the inequality between companies and consumers in terms of key data about particular products that might influence shopping decisions. He points out that even eco-labeling programs do not fully address this “information asymmetry.” He suggests that radical transparency would enable consumers to learn the full story about the true impacts of their purchases.

Chapter 7 — Full Disclosure Chapter 7 — Full Disclosure Synopsis: Synopsis: In this chapter, Goleman describes a cutting-edge tool that he says will help bring radical transparency to the marketplace. Known as GoodGuide, this tool summarizes a wide range of life cycle information about products and rates them according to their environmental, health, and social impacts, thus allowing shoppers to make more informed choices at the point of sale. He suggests that such tools will help people be more mindful and pay closer attention to the impacts of their purchases.

Chapter 8 — Twitter and Buzz Chapter 8 — Twitter and Buzz Synopsis: Synopsis: Using as an example a situation in which British college students protested a bank's fee changes, Goleman shows how the multiplier effect of people sharing knowledge can diminish information asymmetry. He examines how social networking and other technologies can accelerate both buzz and whistle-blowing.

Chapter 9 — Fair and Square Chapter 9 — Fair and Square Synopsis: Synopsis: Goleman describes different sets of research on how ecological and ethical labeling can affect consumer behavior. While cost is often a factor, a rating system can influence consumers when it gives clear information about which choices are better and when “more virtuous” decisions are as accessible as others.

Chapter 10 — The Virtuous Cycle Chapter 10 — The Virtuous Cycle Synopsis: Synopsis: In this chapter, Goleman describes a variety of situations in which

consumers put pressure on companies to improve their products, without the government mandating the changes. He calls this a “virtuous cycle,” when product information influences shoppers’ choices and leads to businesses changing their products.

Chapter 11 — The Chemical Stew Synopsis: Synopsis: Goleman explores some of the health effects of chemicals used in today’s products. He points out that while most consumers assume that the chemicals used today must be deemed safe, the EPA in fact grandfathered some 62,000 industrial chemicals in 1972, most of which have not been tested for health effects. He explains how many different diseases seem to be caused by chronic inflammation from exposure to one or more chemicals.

Chapter 12 — The Amygdala Goes Shopping Chapter 12 — The Amygdala Goes Shopping Synopsis: Synopsis: In this chapter, Goleman describes some of the attributes of the human brain that affect our consumer choices. For example, the amygdala scans the environment for hazards and triggers a reaction when it senses danger; a perception that something is inedible or poison can cause a physical reaction we call disgust. He suggests that transparency can prompt these strong consumer reactions to products and thereby accelerate market change.

Chapter 13 — Tough Questions Chapter 13 — Tough Questions Synopsis: Synopsis: Goleman outlines several questions that company executives would need to consider before responding to problems like a newly-discovered toxicity in a product or changing consumer preferences. He also describes case studies in which large corporations, including Coca-Cola and Procter & Gamble, consciously changed their strategies to become more sustainable. He shows the benefits these companies have seen in embracing more than just the bottom line.

Chapter 14 — The Perpetual Upgrade Chapter 14 — The Perpetual Upgrade Synopsis: Synopsis: In this chapter, Goleman points out that institutional buyers for universities, hospitals, and other organizations have started adding environmental and social mandates to their purchasing recommendations. When institutions like these are able to calculate the environmental and social benefits of switching products through radical transparency, their impact is even greater. He describes how decisions like these can cause a ripple effect and lead to a perpetual upgrading of products to those that are better for health, society, and the environment.

Chapter 15 — Second Thoughts Chapter 15 — Second Thoughts Synopsis: Synopsis: Goleman points out some of the pitfalls of transparency efforts, including poor execution, misguided good intentions, and difficulties of verification. He also suggests that gradual improvements may be “too little, too late” if we don’t look at the underlying causes of problems, including our consumer mentality and the overall amount of stuff we consume.

Chapter 16 — Doing Well by Doing Good Chapter 16 — Doing Well by Doing Good Synopsis: Synopsis: In this final chapter, Goleman describes how radical transparency

would provide an incentive for companies to do good, fostering care of rather than harm toward “the commons.” He conveys the hope that such transparency would encourage the free market to work in the public interest, not solely for profit, and help to heal humans’ relationship with Earth.

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Perfect Order: Recognizing Complexity in Bali (Princeton Studies in Complexity Book 22) by Stephen Lansing

Achieving Perfect Order THE INITIAL IMPETUS for the research that led to this book was the discovery that computer simulations of Balinese water temple networks will self-organize, provided each node of the network is given the capacity to adapt to its local environment. As simulated networks coalesce, their ability to solve problems expands from the level of individual nodes to that of the network as a whole. In this way, the whole becomes something more than the sum of all the parts, a phenomenon noted by Aristotle.

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in the end both are concerned with understanding the moments when change becomes discontinuous, when it leads not merely to more of the same but to something truly different.

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Schneiderman, Jill. The Earth Around Us . Henry Holt and Co.. Kindle Edition.

What Else Should My Neighbor Know? Caryl Edward Buchwald

A few years ago, geologist Allison R. Palmer wrote a short piece for the predecessor of Geology Today wherein he addressed the question: What should my neighbor know? It was Palmer’s clever way to get his audience to think about the challenge of spreading geological knowledge beyond the profession of geology, itself, to the greater world. His major thesis was something to this effect, “If you think education is expensive, try ignorance.”

=There are plenty of problems in the world, and almost all of them have centrally important aspects that can be better understood if we can grasp these fundamental issues: **(1) Earth’s human population, as a whole, continues to grow at a rate unprecedented in world history, or “Exponential arithmetic is not your ordinary arithmetic”;** **(2) The first and second laws of thermodynamics are still operating and are not likely to be revoked;** **(3) Everywhere in the world, we are perturbing large-scale biogeochemical cycles without anticipating exactly what effects will result from our actions.**

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HUMANS: A FORCE OF GEOLOGICAL PROPORTION

Earth has a number of large-scale, biogeochemical cycles, which involve the transfer of material and energy from one place to another and from places of storage to places of activity. Human beings are now so numerous and so powerful that our normal,

everyday activity perturbs these cycles. Sometimes these perturbations cause huge problems because they disrupt systems that have evolved over millennia and that cannot adjust rapidly to the new set of conditions we have imposed. There are many examples, such as cycles of water, carbon, nitrogen, phosphorus, and sulfur among others,

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from "Liberation Science: Putting Science to Work for Social and Environmental Justice" by Steven H. Emerman, Marcia Bjørnerud, Jill S. Schneiderman, Sarah A. Levy

"Chapter 10: Geomimicry for Social and Environmental Justice by Marcia Bjørnerud
Summary Since the time of the industrial revolution, Western technology has been based on an implicit view of Nature as an adversary to be defied, circumvented, or hoodwinked. After two hundred years of believing that we have outsmarted natural laws, we face the planetary-scale consequences of this adolescent attitude toward the Earth. Environmental malefactions and social injustices are arguably both rooted in a distorted sense of the relationship between humans and the natural world. Ecological integrity and human rights are equally endangered when dogma, prejudice, greed and fear obscure our shared past and common destiny. Our collective survival now requires that we learn some humility and study Earth's own history for models of dynamic and durable systems."

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"...in the future, geology may supply an entirely new kind of commodity, an accidental but potent byproduct of two centuries of geologic exploration: the wisdom—both pragmatic and philosophical—embedded in the rock record."

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"Nature itself may be the only common value, and the history of the Earth the only politically neutral narrative, from which all nations may agree to take counsel."

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[last section] disrupted. **The point seems to be that we humans are now a geological force of global proportions, creating and running an experiment for which we have little predictive certainty. Well, there you have it. Here is what my neighbor ought to know about how Earth works. The population is growing rapidly and becoming urbanized at an unprecedented scale. As a whole, we seem to misunderstand the lessons of the laws of thermodynamics—the set of rules governing how energy and matter behave. We cannot make things out of nothing. We cannot throw things away, and it is very hard to clean up messes. We have grown so numerous and so powerful that we are now a geological force of global proportions. We regularly disturb major biogeochemical cycles. Every human being needs to appreciate these three profound ideas. With a future that is environmentally precarious, ignorance of these ideas is just too expensive—its cost could be the livability of our planet.**

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FROM INTERVIEW AT. <https://www.psychologytoday.com/intl/articles/201809/life-in-4-d>:

Has time-consciousness helped you in difficult moments? Could it help others?
I think there is some sort of solace in knowing you're embedded in this very deep, old story that we all share. More broadly, *geology brings together people of different generations and cultures, and we're all focused on this story that's outside us*. It's a really powerful way to build communities, and in that sense, the science has been personally very healing and sustaining for me.

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from "Surfaces and Essences: Analogy as the Fuel and Fire of Thinking" by Douglas Hofstadter, Emmanuel Sander

"Readers will of course have anticipated **the answer namely, that our advantage is intimately linked to categorization through analogy, a mental mechanism that lies at the very center of human thought but at the furthest fringes of most attempts to realize artificial cognition**. It is only thanks to this mental mechanism that human thoughts, despite their slowness and vagueness, are generally reliable, relevant, and insight-giving, whereas computer "thoughts" (if the word even applies at all) are extremely fragile, brittle, and limited, despite their enormous rapidity and precision. As soon as categorization enters the scene, the competition with computers takes on a new kind of lopsidedness but this time greatly in favor of humans. The primordial importance of categorization through analogy in helping living organisms survive becomes obvious if one tries to imagine what it would be like to "perceive" the world in a manner entirely devoid of categories something like how the world must appear to a newborn, for whom each new concept has to be acquired from scratch and with great difficulty. By contrast, seeing the new in terms of the old and familiar allows one to benefit, and at only a slight cognitive cost, from knowledge previously acquired."

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from "New Directions in Sustainable Design" by Adrian Parr, Michael Zaretsky

"Since water is 832 times denser than air, it has a significantly higher energy density."

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from "The Ecological Thought" by Timothy Morton

"Introduction: Critical Thinking The ecological crisis we face is so obvious that it becomes easy-for some, strangely or frighteningly easy-to join the dots and see that everything is interconnected. This is the ecological thought. And the more we consider it, the more our world opens up."

[this whole introduction chapter about totality thinking to be used/through about/ worked through]

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“Chapter I, "Thinking Big," argues that for the ecological thought to lift off, it must escape some terms in which it has been trapped. Terms such as the local, the organic, and the particular have been good for environmentalist social policy. These ideas provide at least a pocket of resistance to globalization. But what about global warming? Doesn't that make a global response necessary? How about the fact that we're witnessing the Sixth Mass Extinction Event? Ecological thinking risks being caught in the thinking risks being caught in the language of smallness and restriction. I use Milton to kick off the discussion, because he offers us one of the most immense viewpoints of all: that of space itself. **Seeing the Earth from space is the beginning of ecological thinking.** The first astronauts, balloon pilots, immediately ately saw Earth as an alien world.³¹ Seeing yourself from another point of view is the beginning of ethics and politics.”

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“The ecological thought imagines interconnectedness, which I call the mesh. Who or what is interconnected with what or with whom? The mesh of interconnected things is vast, perhaps immeasurably so. Each entity in the mesh looks strange. Nothing exists all by itself, and so nothing is fully "itself." There is curiously "less" of the Universe at the same time, and for the same reasons, as we see "more" of it. Our encounter with other beings becomes profound. They are strange, even intrinsically strange. Getting to know them makes them stranger. When we talk about life forms, we're talking about strange strangers. The ecological thought imagines a multitude tude of entangled strange strangers.”

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from "Molecular Red: Theory for the Anthropocene" by McKenzie Wark

"One version of what might constitute a popular, affective way of writing low theory that is close to the experience of the technical and scientific labor of our times might be science fiction. There's no finer exponent of it than Kim Stanley Robinson, to whom we turn next. Robinson is very much a Californian writer, who grew up in the shadow of its booming aerospace industries, but also had time for the Sierra Mountains nature writing of Kenneth Rexroth. He is even, in part at least, a writer shaped by California Marxism. He studied at the University of California (San Diego) after Herbert Marcuse's tumultuous time there, but was shaped by his influence, not to mention that of Fredric Jameson, under whose direction he went on to produce a doctoral thesis on another great Californian writer, Philip K. Dick. Not of least interest in Robinson's work is the way these influences are woven together into a forward-looking fictional world."

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Imagining Extinction: The Cultural Meanings of Endangered Species by Ursula K. Heise

Granted, humans may not normally be able to experience themselves as a species—any more than they are able to experience themselves as a nation: unless, that is, communities produce institutions, laws, symbols, and forms of rhetoric that establish such abstract categories as perceptible and livable frameworks of experience. A great deal of historical and cultural analysis over the past four decades, often building on Benedict Anderson’s and Jürgen Habermas’s seminal studies, has shown such political and cultural processes at work in the emergence of modern European nation-states in the eighteenth and nineteenth centuries. The self-identification of particular communities as nations, these studies show, is historically specific and contingent. **Theorists of cosmopolitanism have long argued that a different set of institutions, laws, symbolic markers, and rhetorical forms might make the framework of “humankind” experienceable in a similar way. And even the “species” framework might not forever remain as phenomenologically ungraspable as Chakrabarty makes it out to be. Surely what being a “species” means, from a biological and ecological as well as a social perspective, is to be situated in a network of lived, existential relations with other species and with the inanimate environment (soil, water, atmosphere, weather patterns).**

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Speculative Everything: Design, Fiction, and Social Dreaming (The MIT Press)

Speculative design props function as physical synecdoches, parts representing wholes designed to prompt speculation in the viewer about the world these objects belong to. This approach requires viewers to creatively engage with the props and make them their own.

Kindle location 752

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Kim Stanley Robinson Scientific American Essay on living on another planet

“Unless all these steps are taken, humans cannot successfully travel to and inhabit other star systems. The preparation itself is a multi- century project, and one that relies crucially on its first step succeeding, which is the creation of a sustainable long-term civilization on Earth. This achievement is the necessary, although not sufficient, precondition for any success in interstellar voyaging. If we don’t create sustainability on our own world, there is no Planet B.”

[https://www.salon.com/2016/01/17/what exactly would it take for humans to ever colonize the milky way partner/](https://www.salon.com/2016/01/17/what_exactly_would_it_take_for_humans_to_ever_colonize_the_milky_way_partner/)

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John Wood online essay

<https://metadesigners.org/Tragedy-Thermostat>

today's producers isolate their consumers from the ecological system that nourishes and sustains them. As a consequence, consumers enjoy strong individual rights of consumption but carry few acknowledged responsibilities, apart from payment. Taking a designer's perspective the paper shows how industrialists encouraged individualism as a catalyst for economic growth.

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When the process takes place within a stridently competitive system of economic production it leads to the self-increasing flow of materials and energy. The system is also sustained by myths of solipsism that encourage individual citizens to consume, despite the inevitable consequences for all. (Hardin, 1977; Festinger, 1957; Sloterdijk, 1988). The paper argues that these myths are created by the advertising and entertainment industries to make us inward looking and socially fragmented. In offering a historical thumbnail sketch of individuation the paper contrasts solipsistic individuation with more co-dependent modes of individuation. As technology becomes more dependency sustaining (Wood, 1989), noumenal, distributed, ubiquitous (Norman, 1999), omniscient, and invisible, these problems are likely to increase. The paper warns that although 'phenomena-feedback' systems would save energy, they might also enslave us as human 'pets'. A better solution would be to use the spirit of individualism to guide us from a macro-capitalism of consumption to a micro-capitalism of production.

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READ THIS from "Climate Code Red: the case for emergency action" by David Spratt, Philip Sutton

"**Scenario planning** can identify features of the future that the organisation would like to help bring about, or new activities that position it well across a wide range of futures."

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A CASE FOR CLIMATE ENGINEERING by David Keith. last paragraphs

About a million years after inventing stone cutting tools, ten thousand years after agriculture, and a century after the Wright brothers flight, humanity's instinct for collaborative tool building has brought us the ability to manipulate our own genome and our planet's climate. **These tools rest on deep knowledge of the natural world accumulated over centuries. This knowledge was built by the efforts of countless individuals—all filled with error and motivated by self-interest—yet each also contributing to the accumulation of understanding. We may use these powers for good or ill, but it is hard not to delight in these newfound tools as an expression of collaborative human effort to understand the natural world.**

The path toward wise use of geoengineering may require us to simultaneously grasp the delight in our new tools along with the humility to see their limits.

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Design for Micro-Utopias: Making the Unthinkable Possible (Design for Social Responsibility) by John Wood

"In seeking new ways of living that compensate for the suicidal tendencies of our species, **this chapter emphasises the importance of 'dreaming', or envisioning new scenarios.** Although we can understand events by reading newspapers and journals, our narcissistic and solipsistic tendencies tend to blind us to important aspects of what is happening. There are many reasons for this, including an anodyne, carefully stage-managed system of representative democracy, led by highly professional politicians. This has brought about a situation in which today's citizens have become choosers, rather than dreamers. **What we urgently need are more imaginative and playful ways of thinking that can be shared and enacted to create a wiser society.**"

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EMOTIONALLY DURABLE DESIGN by Jonathan Chaplan

[This book looks like it has very useful information for my work. CMU Prof]

Ecological awakenings

In 1966, the National Aeronautics and Space Administration (NASA) delivered to the world the first photographic images of our planet from outer space; and for the first time in human history, we experienced the Earth as a holistic and self-supporting organism, peacefully suspended in the dark silence of space. We witnessed with our own eyes the Earth's protective atmosphere, and we were jolted by the evident fragility of this blue gaseous membrane proportionally similar in depth to 'a coat of paint around a football'. 1

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Conceptualizing the act

The devastating environmental impacts of material consumption –such as diminishing natural resources, air and water pollution, waste and global warming –could be seen as legacies of modern times, catalyzed by the enhanced production capabilities of the twentieth century. A growing awareness of this has led the more enlightened industrialists to initiate exploration into the possibilities of what they refer to as 'sustainable consumption'. At first glance, the term 'sustainable consumption' may appear profoundly oxymoronic; the coupling of two seemingly opposed words will do that. However, the concept of sustainable consumption is quite possible, although it appears that the meaning of the word 'consumption' needs clarifying before any real progress can be made here.

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On web page about B Fuller work:

<http://www.nous.org.uk/Boyden.html>

WESTERN CIVILIZATION IN BIOLOGICAL PERSPECTIVE

Patterns in Biohistory

Stephen Boyden

Oxford, 1987.

Our place in nature: past, present and future part 3.

Preface

This document has been produced as part of the Biosensitive Futures Program of the Frank Fenner Foundation (FFF). It is available as a booklet in hard copy from FFF. The purpose of the booklet is to stimulate thought and discussion about the way forward to an ecologically sustainable, healthy and fair society of the future and it introduces the concept and vision of **biosensitivity**.

The booklet summarises

- the biohistorical background to the present human situation on planet Earth
- the major ecological causes for concern today
- the essential characteristics of a biosensitive society

Author Stephen Boyden. Biosensitive Futures.

<http://www.biosensitivefutures.org.au/our-projects/biosensitivefutures>

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Anyone familiar with the ideas of [Buckminster Fuller](#) should find this book especially congenial, as there are discussions of many themes recurrent in his work, such as [energy-accounting](#) and [energy slaves](#). There are also conceptual schemes concerning life conditions and human needs, including intangible factors, which will can be usefully compared with Fuller's [Universal Requirements of a Dwelling Advantage](#).

Boyden's remarks on educational comprehensiveness are also in line with Fuller's:

"extraordinarily little effort is devoted in education to the intellectual process of integration and to attempts to improve understanding of the dynamic interrelationships between the different aspects of reality - aspects which are studied independently in the different areas of specialism and which are covered separately in different courses." (p.299)

The book gives an account of the stages of civilization, from the primeval and early farming stages to the current high-energy phase, discussing economics, health and disease, and ecology. From the viewpoint of this web-site, the author's concluding remarks in the penultimate chapter are especially welcome:

"artistic creativity has an important potential role to play in promoting health and well-being in human populations. In my view any society that fails to provide appropriate incentives and opportunities for creative behaviour and consequently deprives the majority of its members of this kind of experience is performing a serious disservice to humanity. Most contemporary high-energy societies fall into this category." (p.304)

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From RECOUNT booklet in iBooks

David Spratt and ??

CARBON BUDGET RISK MANAGEMENT

Carbon budgets are framed in risk management terms. The more fossil fuel emissions are allowed in the carbon budget, the higher the risk of exceeding 2°C. The smaller the budget, the lower the risk of failure. Like drink driving: the more you drink, the more likely a crash.

For example, the IPCC's most recent assessment says the carbon budget for 2°C is 385 billion tons of carbon (1420 billion tons of CO₂) for a 66% risk of exceeding the target, but 275 billion tons of carbon (1000 billion tons of CO₂) for a 33% risk of exceeding the target.⁵ What it doesn't say is that for a lower – say 10% – risk of exceeding the target, there is no carbon budget available.

So what risk should we take?

Is it reasonable to have a carbon budget that might lead to 3°C of warming? Of course, we would say no. But the fact is that the most frequently advocated carbon budget is for a 33% risk of exceeding 2°C and that budget has a range of outcomes between a low of 1°C but as high as 3.1°C (95% confidence range).

So if we really don't want to exceed 2°C of warming, we have to adopt a budget with a low risk - for example less than 10% - of exceeding the target.

Catastrophic and irreversible consequences at 2°C of warming demand a strong risk management approach:

- We should not take risks with the climate that we would not take with civil infrastructure, where risks of failure are less than one in 10,000 to less than one in a million, or 0.01–0.0001%;
- The 2009 Copenhagen Accord emphasised that 2°C is not a hit-or-miss “target” (which can be exceeded) but is a “cap” (an upper boundary): “To hold the increase in global temperature below 2°C, and take action to meet this objective consistent with science and on the basis of equity”.⁶ Accepting 2°C as a cap necessarily implies a very low or nil risk of exceeding the target; and
- Accounting for carbon cycle feedbacks requires a low risk of exceeding the target because the available budget is reduced by the feedbacks.

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NO CARBON BUDGET REMAINS FOR 2oC CAP

There is strong evidence that for a low risk of exceeding 2oC, there is no carbon budget remaining.

- There are no scenarios available with a “very likely chance (>90%)” of not exceeding the 2°C target without net negative industrial emissions” and “no ensemble member (including even the most stringent mitigation scenarios) limits warming to less than 1.5°C throughout the entire century for any of the probability options”.¹¹
- Research by Global Carbon Project founders Raupach and Canadell show there is no carbon budget left for a 10% risk of exceeding the target (see Figure 1. page 7).¹²
- “Achieving the 2°C warming target, requires a further reduction in cumulative emissions of roughly 180 petagrams of carbon. This implies that we have already surpassed the cumulative emission limit and so emissions must ramp down to zero immediately”.¹³

- The IPCC reported that “to provide a 93% mid-value probability of not exceeding 2°C, the concentration (of atmospheric greenhouse gases) would need to be stabilised at, or below, 350 ppm CO₂e”, that is, below current levels, which means no carbon budget available for 2°C.¹⁴

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The paleoclimate record also tells us that even the current level of CO₂ (without accounting for 75 ppm of non-CO₂ greenhouse gases we have added to the atmosphere) is enough for 3°C or more of warming at equilibrium:

- During middle Miocene, 16-14 million years ago, when temperatures were ~3 to 6°C warmer and sea levels 25 to 40 metres higher than at present, the CO₂ level was similar to modern levels (between 350 and 400 ppm).²⁴
- In the early-to-mid Pliocene, 5–3 million years ago, temperatures were 3°C above pre-industrial and CO₂ levels were 360-400 ppm, very similar to today. The northern hemisphere was free of glaciers and ice sheets, beech trees grew in the Transantarctic Mountains and sea levels were 25 metres higher.²⁵

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In reality, 2°C is in fact the boundary between dangerous and very dangerous climate change, and 1°C warmer than human civilisation has ever experienced.

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REPORT CONCLUSION

In the lead up to the forthcoming Paris talks, policy makers through their willful neglect of the evidence are in effect normalising a 2.5–3°C global warming target. It’s time to “do the math” again.

Effective policy making can only be based on recognising that climate change is already dangerous, and we have no carbon budget left to divide up. Big tipping-point events irreversible on human time scales and large-scale positive feedbacks are already occurring at less than 1°C of warming. It is clear that 2°C of climate warming is not a safe cap.

This evidence demonstrates that action is necessary at a faster pace than most policy makers conceive is possible. Decades of procrastination mean there is no longer sufficient time for an incremental and non-disruptive reduction in emissions.

Only a whole-of-society rescue plan, understood as action at emergency speed outside of the business-as-usual political mode, can provide hope of retaining a livable planet for ourselves and future generations.

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Article | Published: 05 February 2018

A good life for all within planetary boundaries

by Daniel W. O’Neill, Andrew L. Fanning, William F. Lamb & Julia K. Steinberger

Nature Sustainability, volume 1, pages 88–95 (2018) | [Download Citation](#)

[Springer Link](#) for whole article. [Get this](#)

Abstract

Humanity faces the challenge of how to achieve a high quality of life for over 7 billion people without destabilizing critical planetary processes. Using indicators designed to

measure a 'safe and just' development space, we quantify the resource use associated with meeting basic human needs, and compare this to downscaled planetary boundaries for over 150 nations. We find that no country meets basic needs for its citizens at a globally sustainable level of resource use. Physical needs such as nutrition, sanitation, access to electricity and the elimination of extreme poverty could likely be met for all people without transgressing planetary boundaries. However, the universal achievement of more qualitative goals (for example, high life satisfaction) would require a level of resource use that is 2–6 times the sustainable level, based on current relationships. Strategies to improve physical and social provisioning systems, with a focus on sufficiency and equity, have the potential to move nations towards sustainability, but the challenge remains substantial.

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A safe and just space

There have been two recent, complementary advances in defining biophysical processes, pressures and boundaries at the planetary scale. The first is the planetary boundaries framework, which identifies nine boundaries related to critical Earth-system processes.

The boundaries jointly define a 'safe operating space', within which it is argued the relatively stable conditions of the Holocene may be maintained.

Of the seven measured planetary boundaries, four are currently transgressed (biosphere integrity, climate change, biogeochemical flows and land-system change).

The second advance is the estimation of environmental 'footprint' indicators for multiple types of biophysical resource flows. Footprint indicators associate specific environmental pressures (for example, CO₂ emissions, material extraction, freshwater appropriation) with the consumption of goods and services⁵. This approach assigns responsibility for embodied resource use to final consumers, and includes the effects of international trade.

We combine these two approaches to measure sustainability at the national scale, by comparing national consumption-based environmental footprints to 'downscaled' planetary boundaries.

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DOUGHNUT ECONOMICS by Kate Raworth. Kindle location 1126

The nine planetary boundaries give a compelling first answer to that question, and in Chapter 6, we will explore just how the economy's use of matter and energy can be redesigned so that it works with, not against, the cycles of life that those boundaries seek to protect.

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Explaining systems: Investigating middle school students' understanding of emergent phenomena October 2000 · Journal of Research in Science Teaching 37(8):784 - 806 DOI: 10.1002/1098-2736(200010)37:8<784::AID-TEA3>3.0.CO;2-E David E. Penner

Science, as with all cognitive activities, is fundamentally a matter of interpretation, sense-making, and explanation. This study focused on a small group of middle school students as they developed understanding of a particular type of phenomena: emergent systems. Such systems are notable in that macro-level properties emerge as the result of micro-level interactions between system components. I describe students' initial understanding of emergent systems, as well as the ways in which their thinking came to reflect the following heuristics: (a) recognition that there may not be a singular causal force underlying the system; (b) distinguishing between micro- and macro-levels of analysis; and (c) comprehending that even small changes at the micro-level can have significant effects at the macro-level (Resnick, 1994). I conclude by considering some implications for science education.

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[not sure where this quote comes from]

“we suggest that given the complexity of the concepts and lack of opportunity to learn them, there’s no particular reason that non-scientists would understand or be able to act upon climate change issues, and that the problem needs to be reframed in terms of how we can help people of all ages learn what they need to know. The current adult population grew up in a time when the curriculum did not offer the understandings necessary to enable people to understand the language or patterns of nature in general, or climate change issues in particular.

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There is deep interest in the question of what people need to learn to understand the biosphere, and many ideas from diverse and eloquent perspectives on what educational components need to be included (e.g., Thomashow, 2002). While it is an important first step, as others have argued (e.g., Bostrom et al., 1994), to assess what the public’s knowledge looks like in contrast to scientific determinations of what they need to know, the educational problem for achieving understanding extends far beyond that. We need to consider the terrain between lay and expert mental models and figure out what it takes to help learners traverse that terrain. This involves understanding the patterns in how people perceive and think about environmental issues—cognitive and perceptual assumptions or default patterns that are likely to impede understanding and the ability to act. Further, if we set educated action as opposed to inert knowledge as the bar for success, then the educational challenges are extensive. We need to help the public develop the ability to understand climate change but also the sensitivity to perceive opportunities that invite action and, subsequently, the inclination to act.

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Chapter 17

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LEARNING CAUSALITY IN A COMPLEX WORLD: UNDERSTANDINGS OF CONSEQUENCES- Causal behaviour Air Pressure SECTION IN book by Tina Grotzer

How does passive causality complicate matters for students? First, students are unlikely to recognize air pressure-related phenomenon that are not “event-like.” Second, when they do attempt to reason about air pressure, they are likely to characterize it as an active causal agent—substituting notions of force for pressure.

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Air is around us all of the time, so we are accustomed to the presence of air pressure. Beyond this, our bodies continually adapt to the sea of air in which we live. We are usually unaware of our bodies’ adaptations; they only become obvious when air pressure changes rapidly, such as when our ears pop in an ascending airplane. When students are not aware of air pressure as a possible cause, they typically turn to concrete, obvious variables to try to explain pressure-related phenomena. For example, when asked why a balloon partially deflates when driving from higher to lower altitude, most students speculate about the possibility of obvious variables, such as a hole in the balloon, rather than changes in non-obvious variables, such as air pressure.

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Students typically characterize air pressure as an active push in one direction, a unidirectional force that pushes down. This could result from substituting a force conception for pressure. Or it could be a natural extension of students’ understanding of pressure as the force per unit of surface area, where the force is applied perpendicularly

to the surface area ($\text{Pressure} = \frac{\text{Force}}{\text{Area}}$). However, air pressure acts omnidirectionally.

Because particles are moving in all directions, every direction that we choose for a unit of surface area will have particles that hit it perpendicularly. Visualizing this requires students to take the simple case of one surface and extend it to all the possible surfaces that molecules could bounce off of. This is cognitively challenging!

In order to grasp that air pressure acts omnidirectionally, students also have to realize that molecules that make up the air can bounce in all directions, not just down.

In order to grasp that air pressure acts omnidirectionally, students also have to realize that molecules that make up the air can bounce in all directions, not just down.

Students often draw their models of air pressure unidirectionally, with pressure arrows pointing downward. They tend to think of air pressure as “pushing down on them” similar to the way they think of gravity pulling them towards Earth’s surface. This is evident in students’ conceptions of air pressure, and particularly recurrent with water pressure. As with air pressure, the idea of water pressure existing equally in all directions is counter-intuitive to students. 10,11

Pressure acting in a greater downwards direction than in a sideways one is more appealing to students

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In summary, it is likely that your students' ideas will fall along a continuum of those presented here for each aspect of causality. **A goal of this curriculum is to help students learn to reason about these three aspects of causality—non-obvious causes, passive causal agency, and relational causality—so that they can grasp the scientifically accepted explanations for pressure related phenomena.*** Often, understanding one of these aspects supports understanding of the others; for instance, recognizing the non-obviousness of air pressure can bring students around to the relational model. If this happens with your students, they might see overlap within these lessons. Through the activities in this module, all students should make some progress towards models of air pressure that have greater explanatory power.

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From ATMOSPHERE OF HOPE by Tim Flannery Kindle

“Some of the tools that climate scientists use have also changed enormously. Our capacity to model the climate system in time and space, for example, has been transformed. The models used in the 1990s could operate across four orders of magnitude in time and space, while current ones operate across five orders of magnitude. By way of illustration, four orders of magnitude in space extends from a millimetre to 10,000 millimetres (10 metres), while five orders extends from a millimetre to 100,000 millimetres (100 metres). The capacity of the climate models continues to grow at a rate of around an order of magnitude per decade, with each decadal increase involving 10,000 times more calculations for space alone than were required previously. When climate models are able to operate across 14 orders of magnitude—from milliseconds to millennia, and millimetres to thousands of kilometres—they will be able fully to model Earth's climate system.”

Despite their vast increase in computational power, the models remain consistent in telling us that our Earth is warming, and will continue to warm in proportion to the volume of fossil fuel we burn. What has changed is the detail they reveal about the things that will unfold. While no climate model can predict the future—simply because the future is impossible to predict—the increasing computational power of the models means that they are becoming ever more useful at explaining how climatic changes are being influenced by humanity.

Studies of past climates are also becoming ever more informative.” 247

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“The £ 25 million Virgin Earth Challenge (VEC)—at the time the richest climate prize ever offered—was born from those ruminations. Branson asked me if I'd be a judge, and I agreed, joining Al Gore, James E. Hansen, James Lovelock and Sir Crispin Tickell. Over the years I've watched in astonishment as the applications rolled in. They have fundamentally altered my perception about how we might respond to the climate crisis. Back in 2007 the technologies and methods presented were rudimentary. As we draw closer to 2020, and as humanity's carbon emissions levels continue to grow,

some of the technologies encouraged by the Branson initiative have developed to look more and more like indispensable tools for our survival.

Moreover, it has recently become clear that drawing a gigatonne of carbon out of the atmosphere is just a beginning. The 2015 American Academies report on CO2 removal states that ‘reducing CO2 concentration by 1 ppm per year would require removing and sequestering CO2 at a rate of around 18 gigatonnes per year’. That’s around 4.8 gigatonnes of carbon annually—almost five times the VEC target. Reducing CO2 concentrations by 100 ppm (and so returning them close to what they were before the Industrial Revolution) would require removing around 1800 gigatonnes of CO2—the same amount that was added by human activity between 1750 and 2000.²

More than 10,000 submissions to the Virgin Earth Challenge have now been received. In 2011 these were pared down to a shortlist of 11 approaches. From restoring land and reversing ecosystem degradation to the capture of CO2 using resins, all 11 fall into two fundamental categories—biological and chemical—according to the ways they extract carbon from the atmosphere and/ or the oceans.” 2010-2033

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“Getting solid numbers behind the effects, such as the scale, longevity and permanence of carbon removal using biological approaches, is absolutely critical.” 2033

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<https://climateandcapitalism.com/2019/01/31/why-the-anthropocene-is-not-climate-change-and-why-that-matters/>

Why the Anthropocene is not ‘climate change’ – and why that matters

Posted on January 31, 2019

Climate is just one part of the Earth System. If we focus on that alone, we will misunderstand the complexity of the danger posed by unprecedented planetary change. BY Julia Adeney Thomas

“Alarming as each factor is on its own, the concept of the Anthropocene brings all these factors and others together. This is the only way that we can understand Earth as a single reverberating system with feedback loops and tipping points that we can’t yet predict.

The Anthropocene’s interrelated systematicity presents not a problem, but a multidimensional predicament. A problem might be solved, often with a single technological tool produced by experts in a single field, but a predicament presents a challenging condition requiring resources and ideas of many kinds. We don’t solve predicaments; instead, we navigate through them.

Collaboration among scientists, policymakers, social scientists, humanists, and community leaders is key to contending with the Anthropocene.”

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“Reducing our problem to climate change, then to CO₂, and finally to measuring emissions only at the point of energy production is a dramatic misrepresentation of our dilemma. An Anthropocene perspective is needed to keep the totality of the predicament in view.

Slowing climate change is crucial but navigating its challenges is only possible if it is understood as one facet of planetary overshoot. The challenges of our altered, unpredictable Earth System cannot be met by technological tinkering within the very systems that pushed it over the edge in the first place. There’s nothing for it but to roll up our sleeves and begin the hard work of transforming our political and economic systems with the aims of decency and resilience.”

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From Planetary Boundaries to national fair shares of the global safe operating space – How can the scales be bridged?

BY Tiina Häyhä^{a,*}, Paul L. Lucas^b, Detlef P. van Vuuren^{b,c}, Sarah E. Cornell^a, Holger Hoff^{d,e}

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ABSTRACT

The planetary boundaries framework proposes quantitative global limits to the anthropogenic perturbation of crucial Earth system processes, and thus marks out a planetary safe operating space for human activities. Yet, decisions regarding resource use and emissions are mostly made at less aggregated scales, by national and sub-national governments, businesses, and other local actors. To operationalize the planetary boundaries concept, the boundaries need to be translated into and aligned with targets that are relevant at these decision-making scales. In this paper, we develop a framework that addresses the biophysical, socio-economic, and ethical dimensions of bridging across scales, to provide a consistently applicable approach for translating the planetary boundaries into national-level fair shares of Earth’s safe

operating space. We discuss our findings in the context of previous studies and their implications for future analyses and policymaking. In this way, we link the planetary boundaries framework to widely-applied operational and policy concepts for more robust strong sustainability decision-making.

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1. Introduction

Consumption of natural resources at global scale has increased rapidly in recent decades. This increase, largely driven by population growth, economic development, and lifestyle changes, has been a prime driver of changes in the Earth System and resulted in severe environmental degradation (Dasgupta and Ehrlich, 2013; Steffen et al., 2015a; Vitousek et al., 1997). Over time, many concepts have been proposed to communicate the undesirability of further environmental degradation, framing the impact in terms of transgression of critical levels with respect to system integrity. These include safe minimum standards (Bishop, 1978; Ciriacy-Wantrup, 1952; Crowards, 1998), critical loads (UNECE, 1979), carrying capacity (Daily and Ehrlich, 1992), limits to growth (Meadows et al., 1972), and tolerable windows or guardrails (Bruckner et al., 2003, 1999; WBGU, 1995). Examples of application of such concepts in national environmental policy include the

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===== **Summary**

“5. The way forward: insights for national applications

In this paper we have assessed key challenges for translating Planetary Boundary processes to national policy targets. It is important to provide means to link environmental targets across different scales to make them operational for policy making. The planetary boundaries have complex interactions, so in practice blunt simplifications need to be made to enable and mobilise societal action for global sustainability. In this paper, we have discussed several key concepts, methods, and tools to do this. Our concluding messages are the following:

Bridging scales needs to address distinct biophysical, socio-economic, and ethical dimensions. In translating the planetary boundaries into national level policy targets, these three dimensions should be considered explicitly. The biophysical dimension deals with the geographical scales of the planetary boundaries processes and their interactions. The socio-economic dimension addresses the sub-global links created by production and consumption patterns and through international trade. Finally, the ethical dimension addresses equity in sharing the global safe operating space and recognizing the differences between countries' rights, abilities, and responsibilities. The reason for us to distinguish between the socio-economic dimension (e.g., via trade) and the ethical dimension (via equity and fairness considerations) in translating and operationalizing the PBs is that the former is given in a globalizing world, while the latter is yet to be established. We see it being debated in global governance, as is

currently happening in the climate negotiations and agreements. Therefore, for national policy-making, these two dimensions of PB translation present very different points of departure. So far, national PB studies have made different choices about how to apply and balance these dimensions. We have looked closely at five studies that provide important examples of how sub-global targets can be derived. Combining insights from these previous studies within our three-dimensional approach provides a framework for good practice guidelines for future applications.

A key distinction can be made between planetary boundary processes that directly impact the (relatively) stable global Holocene baseline of a major Earth system component and the spatially heterogeneous processes connecting multiple components. For globally manifest processes, the decision about national responsibility for biophysical impact is analytically relatively straightforward. It is mostly about the contribution of countries to global commons problems, for which principles for allocation are well explored. The spatially heterogeneous, systemically connected processes have only recently been seen as global problems through scientific insights about Earth system dynamics and global socio-economic connectivity. These may not show up as nationally important issues if only territorial approaches are applied. It takes a more in-depth life cycle or consumption-based analysis to show where there is a substantial national responsibility. Fairness and equity debates that are currently articulated for climate, chemical pollution, and biodiversity are probably going to need to extend to other issues relating to land, water, and air quality, as the globally systemic nature of their connections becomes more evident.

There is a need to better connect top-down and bottom-up approaches to operationalizing the PB concept at the sub-global scale because relevant processes operate at different scales. A major challenge is that integrative approaches at the global scale (Earth system science) and local scale (social-ecological resilience, local sustainability assessments) are usually based on different methodologies and disciplines. Concepts, techniques, and tools need to be developed and adapted based on the more theoretical considerations we have outlined. The techniques and tools presented in this paper can help to bridge the gaps between global and local scale approaches and targets and with that foster vertical policy coherence (across scales) and also horizontal policy coherence (across environmental issues, PBs, and sectors).

The links among the boundaries need to be better addressed, as do the links between the boundaries and human wellbeing. Achieving sustainable development means staying within global environmental boundaries and at the same time ensuring adequate resources for all. When apportioning the global safe operating space to country scale, the fairness aspect becomes crucial. Understanding the implications of different equity principles can give more insights to fairness discussions. A nexus approach is useful for linking environmental and social policy objectives in ways that can point more directly to national interests. For example, requirements for food, energy, and water security link ecosystems and resource management at multiple scales with human wellbeing.

The Sustainable Development Goals could be used as a basis for reframing the PB concept towards a safe operating space agenda. The SDGs are a globally agreed framework of goals and targets, together addressing a broad range of interrelated challenges for sustainable human development. The 2030 Agenda thereby provides a facilitating context for the governance of the planetary boundaries. It places the PB concept in the broader context of sustainable development. By more explicitly linking the PBs to their underlying and interrelated social, economic, environmental, and institutional dynamics, the approach we discussed in this paper can inform the development of biophysically grounded and socio-economically responsible, fair and just national shares of the global challenges.

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Economic Growth and Carbon Emissions: The Road to ‘Hothouse Earth’ is Paved with Good Intentions. By Enno Schröder and Servaas Storm* + Working Paper No. 84 November 2018

https://www.ineteconomics.org/uploads/papers/WP_84.pdf

ABSTRACT

All IPCC (2018) pathways to restrict future global warming to 1.5°C (and well below an already dangerous 2°C) involve radical cuts in global carbon emissions. Such de-carbonization, while being technically feasible, may impose a ‘limit’ or ‘planetary boundary’ to growth, depending on whether or not human society can decouple economic growth from carbon emissions. Decoupling is regarded viable in global and national policy discourses on the Paris Agreement—and claimed to be already happening in real time: witness the recent declines in territorial CO₂ emissions in a group of more than 20 economies. However, some scholars argue that radical de-carbonization will not be possible while increasing the size of the economy. This paper contributes to this debate as well as to the larger literature on climate change and sustainability. First, we develop a prognosis of climate-constrained global growth for 2014-2050 using the Kaya sum rule. Second, we use the Carbon-Kuznets-Curve (CKC) framework to empirically assess the effect of economic growth on CO₂ emissions using measures of both territorial (production-based) emissions and consumption-based (trade- adjusted) emissions. We run panel data regressions using OECD ICIO CO₂ emissions data for 61 countries during 1995-2011; to check the robustness of our findings we construct and use panel samples sourced from alternative databases (Eora; Exio; and WIOD). Even if we find evidence suggesting a decoupling of production-based CO₂ emissions and growth, consumption-based CO₂ emissions are monotonically increasing with per capita GDP (within our sample). We draw out the implications of these findings for climate policy and binding emission reduction obligations.

Keywords: Carbon Kuznets Curve; Climate change; Economic growth; Production-based CO₂ emissions, Consumption-based CO₂ emissions; Decoupling; Kaya Identity; Paris Agreement.

JEL codes: F64; Q54; Q55; Q56

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+ **The paper was written keeping in mind Ludwig Wittgenstein's maxim: "Nothing is so difficult as not deceiving oneself."**

"What makes both the 'Hothouse Earth' paper and the recent IPCC report remarkable, is that their authors argue that runaway climate change is still preventable: technical (engineering) solutions (including quick fixes and negative-emissions technologies) to bring about deep de-carbonization are available and are beginning to work (e.g. see Table S5, Steffen et al. 2018; see also: Millar et al. 2017; Fankhauser and Jotzo 2017; Geels et al. 2017). But available solutions happen to go against the economic logic and the corresponding value system that have dominated the world economy for the last half decade—a logic to scale back (environmental) regulations, pamper the oligopolies of big fossil-fuel corporations, power companies and the automotive industry, give free reign to financial markets and prioritize short-run shareholder returns (Speth 2008; Klein 2014; Malm 2016; Storm 2017). Hence, as Steffen et al. (2018) write, the biggest barrier to averting going down the path to 'Hothouse Earth' is the present dominant socioeconomic system, based as it is on high-carbon economic growth and exploitative resource use (Speth 2008; Malm 2016; McNeill and Engelke 2016). Attempts to modify this system have met with some success locally, but very little success globally in reducing GHG emissions. There exists a big gap between the political rhetoric on climate action as in the 'voluntarist' COP21 and the reality of growing GHG emissions. We will only be able to phase out greenhouse gas emissions before mid- century if we shift our societies and economies to a 'wartime footing', suggested Will Steffen, one of the authors of the 'Hothouse Earth' paper in an interview (Aronoff 2018). His analogy of massive mobilization in the face of an existential threat suggests directional thrust by state actors, smacks of planning and public interventionism, and goes against the market-oriented belief system of most economists (Storm 2017). "Economists like to set corrective prices and then be done with it," writes Jeffrey Sachs (2008), adding that "this hands-off approach will not work in the case of a major overhaul of energy technology." Climate stabilization requires a fundamental disruption of hydrocarbon energy, production and transportation infrastructures, a massive upsetting of vested interests in fossil-fuel energy and industry, and large-scale public investment—and all this should be done sooner than later.

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The Great Disruption: How the Climate Crisis Will Transform the Global Economy by Paul Gilding

Perhaps the most significant thing I learned over more than a decade doing this work was that companies' capacity on issues like sustainability is limited in material impact until the market and regulatory context are in place to reward or punish them for their performance. While we had success in getting our clients focused on the right

activities, even the best of them soon came across limits to what they could achieve as leadership companies in front of market trends.

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“...environmental justice is a major topic in this context and current debate, aimed as it is at raising consciousness and creating a new citizenry.”

**Il Tolomeo [online] ISSN 2499-5975 Vol. 19 – Dicembre | December | Décembre
2017 [print] ISSN 1594-1930**

Amitav Ghosh: Climate Change Here and Now

Carmen Concilio (Università degli Studi di Torino, Italia)

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In that lecture, which is also the first part of the volume, *Stories*, Amitav Ghosh tries to answer the following questions: why is serious fiction loath to deal with climate change? And if it does, when does that happen? Why is it that it is immediately classified as ‘sci-fi’, or relegated to a subgenre? The answer is complex and composite, yet Ghosh has an immediate first proposal. He claims that

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the challenges that climate change poses [...] derive ultimately from the grid of literary forms and conventions that started to shape the narrative imagination in precisely that period when the accumulation of carbon in the atmosphere was rewriting the destiny of the earth (7; emphasis added).

2 Ghosh 2016. All references are to this edition.

Thus, our frame of mind, our way of reasoning, our episteme is subjected to a grid, a model, a pattern that conditions and limits our imagination. That grid works as a normative Super-ego that imposes rules, while concealing other possible shapes and patterns. Climate change has been removed from our consciousness as if it were ‘akin to’ extra-terrestrial phenomena, not of this world. We have become blind to life-changing threats, writes Ghosh. And therefore the Italian title of the volume has explicitly become *La grande cecità* (2016). It is Chakrabarty in his essay “The Climate of History” (2009), who specifies that in this era of the “Anthropocene [...] humans have become geological agents, changing the most basic physical processes of the earth.” (2016, 9)

The climate crisis is a crisis of culture and of the imagination. For our imagination has been moulded by, for instance, Jane Austen’s narratives of green meadows. This cultural matrix, this grid, has its origins in the carbon economy, in capitalism and in colonialism. But our time of distraction, evasion, and concealment is a time of great derangement, says Ghosh.

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The most challenging attitude, however, consists in understanding ways of speaking the same language as nature, only we do not consider them as communicative acts requiring an interpretation. But **the Anthropocene has shown that nature speaks through us. So a new language must be sought: perhaps a language made of**

images, no longer a language based on logocentrism. That is why cinema and tv are more successful in dealing with climate change than fiction. One more element that was expunged from modern novels is images – illuminated pages, illustrations, pictorial images – and that goes back to the invention of print. Luckily, the Internet allows an easy matching of words and images and therefore there is hope for the future, for new hybrid forms, so that even our reading practice should change accordingly.

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Finally, in this chapter Amitav Ghosh makes a plea to a mobilization of democratic forces – ground roots activism, religious activism and civic activism – but also to a new literature and new art forms on climate change. Amitav Ghosh's last chapter, a call to arms that balances the j'accuse tone of the previous chapters with his invitation to activism, is in tune with the closing chapter of Ramachandra Guha's *Environmentalism. A Global History* (1999), who also mentions the mobilization of various social and civic forces together with religious groups, as a possible way to the future of our planet.

Together with activism a new art-ivism is also encouraged in the forms of fictions that stage anthropogenic climate change and its specific, scientific paradigm. In this way Amitav Ghosh's essay achieves its target of inspiration for writers, artists and a whole world of readers. It is not a chance that Amitav Ghosh is quoted in a volume addressed to young adults: *Teaching Climate Change to Adolescents* (Beach et al. 2017).

It must be said that Amitav Ghosh is not alone in his call, Naomi Klein, Martha Nussbaum, Slavoj Zizak and Zigmunt Bauman also continue to express concern for the future of the planet, for the rising of people's consciousness and for wise socio-political actions.

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Book. GROWTH FETISH by Clive Hamilton.

Among the many who have studied the role of work, Jahoda argues that employment provides five categories of psychological experience that are vital to wellbeing – *time structure, social contact, collective effort or purpose, social identity or status, and regular activity*. Most of all, and notwithstanding the role of consumption in modern identity formation, *work continues to provide a sense of personal identity, and it for this reason above all that in wealthy societies the wellbeing of workers declines so dramatically when they become unemployed*. While the ostensible purpose of employment is to earn income in order to consume, in modern times the unemployed suffer most not from material deprivation but from the corrosive psychological impacts of exclusion from meaningful activity and the concomitant absence of time structure, idleness, impoverishment of social experience, and loss of social status. Jahoda comments on how unemployment eats away at one's sense of self: 'Because of widespread consensus in public life about the social status assigned to varying jobs, people tend to adopt this assignation as one clear element in defining themselves to themselves and are reluctant to dispense with this support for their personal identity'.

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From TEACHING CLIMATE CHANGE IN THE HUMANITIES Editors: Stephen Siperstein, Shane Hall, Stephanie LeMenager

16 VISUALIZATIONS CHAPTER

“Global Warming’s Terrifying New Math”: 2 ° Celsius (threshold for atmospheric temperature increase),

565 gigatons (allowable pre-2050 carbon dioxide emissions to avoid crossing this threshold),

2795 gigatons (coal currently in hydrocarbon corporation reserves).

From these calculations McKibben proposes a worldwide campaign to pressure institutions to divest from fossil fuel companies and keep those 2795 gigatons underground.

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From TEACHING CLIMATE CHANGE TO ADOLESCENTS by Richard Beach (Author), Jeff Share (Author), Allen Webb (Author)

Conceptual Understandings for Critical Media Literacy Conceptual Understandings

Questions 1. Social Constructivism All information is co-constructed by individuals and/ or groups of people who make choices within social contexts.

WHO are all the possible people who made choices that helped create this text?

2. Languages/ Semiotics Each medium has its own language with specific grammar and semantics.

HOW was this text constructed and delivered/ accessed?

3. Audience/ Positionality Individuals and groups understand media messages similarly and/ or differently depending on multiple contextual factors.

HOW could this text be understood differently?

4. Politics of Representation Media messages and the medium through which they travel always have a bias and support and/ or challenge dominant hierarchies of power, privilege, and pleasure.

WHAT values, points of view, and ideologies are represented or missing from this text or influenced by the medium?

5. Production/ Institutions All media texts have a purpose (often commercial or governmental) that is shaped by the creators and/ or systems within which they operate.

WHY was this text created and/ or shared?

6. Social & Environmental Justice Media culture is a terrain of struggle that perpetuates or challenges positive and/ or negative ideas about people, groups, and issues; it is never neutral.

WHOM does this text advantage and/ or disadvantage?

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This underlines the importance of 'thinking beyond the possible'. The notion of 'attainability' reflects an important aspect of the way the human mind works. If we want something we are likely to try to reach out for it. However, if we adamantly believe it be unreachable we will probably ignore it. If we can prove to ourselves that something is desirable and attainable we may try to sustain the experience.

TABLE 8.1

Four orders of synergy First Order Synergy Synergies that emerge from the sharing of data. These would include smart materials, nano-scale metallurgy, as developed by Toyota (cf. 'gum metal'), large-scale projects that bring surprising results, such as Buckminster Fuller's floating geodesic city.

Second Order Synergy Synergies that emerge from the sharing of information. These would include synergies that emerge from smart systems or (for example the thermostat), or biological systems, such as Emperor Penguins huddling together to keep warm.

Third Order Synergy Synergies that emerge from the sharing of knowledge (for example flying geese, or collaboration systems, such as cooperation using tag-based web media).

Fourth Order Synergy Synergies that emerge from the sharing of wisdom (for example (for example James Lovelock's Gaia hypothesis (Lovelock, 1995), or what Buckminster Fuller called Nature's synergy-of-synergies).).

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DESIGN FOR MICRO UTOPIAS: MAKING THE UNTHINKABLE POSSIBLE by John Wood

Arguably, the unthinking acceptance of this system is what stops us from visualising Utopia. For us, the politics of 'blame' is more familiar than the politics of resistance, and the politics of resistance is easier than the politics of the collective imagination. Ironically, there are changes that, in private, politicians will admit are needed, but which would prove highly unpopular to address. We are desperately in need of new visions, but the more professional our politicians become, the less space is left for the private imagination. In a prosperous society of comfort and speed the perceived need for dreaming may seem to be distant. This puts us in a dangerous predicament. In order to move beyond cynicism and pessimism, we must therefore learn to dream.

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For this reason, envisioning and exchanging dreams of better possible futures should be seen as a civic duty that is far more important than voting or paying taxes. By 'dreaming' I do not mean choosing the most exotic, outrageous, or selfish lifestyles from a repertoire of holiday or retirement fantasies.

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Edwards, Paul N.. A Vast Machine (Infrastructures) . The MIT Press. Kindle Edition.

Most of this book has been about making the widget: building stable, reliable knowledge of climate change. I have argued that this knowledge-production process works through infrastructural inversion: *constantly unpacking, re-examining, and revising both historical evidence and predictive models. In a knowledge-production process that involves continuous contestation, you are never going to get a single universal data image, or a single uniformly agreed-upon projection. Instead you will get shimmering data, shimmering futures, and convergence rather than certainty.*

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Buckminster Fuller SPACESHIP EARTH

Fuller, R. Buckminster. Operating Manual for Spaceship Earth (Page 111-112). The Estate of R. Buckminster Fuller. Kindle Edition.

But we can scientifically assume that by the twenty- first century either humanity will not be living aboard Spaceship Earth or, if approximately our present numbers as yet remain aboard, that humanity then will have recognized and organized itself to realize effectively the fact that humanity can afford to do anything it needs and wishes to do and that it cannot afford anything else. As a consequence Earth-planet-based humanity will be physically and economically successful and individually free in the most important sense. While all enjoy total Earth no human will be interfering with the other, and none will be profiting at the expense of the other. Humans will be free in the sense that 99.9 percent of their waking hours will be freely investable at their own discretion. They will be free in the sense that they will not struggle for survival on a "you" or "me" basis, and will therefore be able to trust one another and be free to co-operate in spontaneous and logical ways.

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Sim Van Der. Ecological Design Book

Ecological sustainability, in contrast, embraces assumptions very different from the thinly veiled business-as-usual optimism of Our Common Future. It requires limits to technology, limits to material wants, limits to the stress placed on the biosphere, and limits to hubris.

Four of David W. Orr's characteristics of ecological sustainability are worth summarizing here.¹

First, people are finite and fallible. The human ability to comprehend and manage scale and complexity has limits. Thinking too big can make our human limitations a liability rather than an asset.

Second, a sustainable world can be redesigned and rebuilt only from the bottom up. Locally self-reliant and self-organized communities are the building blocks for change.

Third, traditional knowledge that coevolves out of culture and place is a critical asset. It needs to be preserved, restored, and used.

Fourth, the true harvest of evolution is encoded in nature's design. Nature is more than a bank of resources to draw on: it is the best model we have for all the design problems we face.“

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From Scranton, Roy. Learning to Die in the Anthropocene. Page 107-108

Our collective obligation to maintain traditional humanistic study in the post-humanist era is at once developmental and prophylactic: we must practice interruption to nurture new flows and at the same time to guard against them.

As we struggle, awash in social vibrations of fear and aggression, to face the catastrophic self-destruction of global civilization, the only way to keep alive our long tradition of humanistic inquiry is to learn to die. **We must practice suspending stress-semantic chains of social excitation through critical thought, contemplation, philosophical debate, and posing impertinent questions. We must suspend our attachment to the continual press of the present by keeping alive the past, cultivating the info-garden of the archive, reading, interpreting, sorting, nurturing, and, most important, reworking our stock of remembrance. We must keep renovating and innovating perceptual, affective, and conceptual fields through recombination, remixing, translation, transformation, and play. We must inculcate ruminative frequencies in the human animal by teaching slowness, attention to detail, argumentative rigor, careful reading, and meditative reflection. We must keep up our communion with the dead, for they are us, as we are the dead of future generations.**

Wars begin and end. Empires rise and fall. Buildings collapse, books burn, servers break down, cities sink into the sea. Humanity can survive the demise of fossil-fuel civilization and it can survive whatever despotism or barbarism will arise in its ruins. We may even be able to survive in a greenhouse world. Perhaps our descendents will build new cities on the shores of the Arctic Sea, when the rest of the Earth is scorching deserts and steaming jungles. If being human is to mean anything at all in the Anthropocene, if we are going to refuse to let ourselves sink into the futility of life without memory, then we must not lose our few thousand years of hard-won knowledge, accumulated at great cost and against great odds. We must not abandon the memory of the dead.

As biological and cultural diversity is threatened across the world by capitalist monoculture and mass extinction, we must build arks: not just biological arks, to carry forward endangered genetic data, but also cultural arks, to **carry** forward endangered wisdom. The library of human cultural technologies that is our archive, the concrete record of human thought in all languages that comprises the entirety of our existence as historical beings, is not only the seed stock of our future intellectual growth, but its soil, its source, its womb. **The fate of the humanities, as we confront the end of modern civilization, is the fate of humanity itself.**

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From Kenneth Boulding 1966 talk The Economics of the Coming Spaceship Earth

Economists in particular, for the most part, have failed to come to grips with the ultimate consequences of the transition from the open to the closed earth. One hesitates to use the terms "open" and "closed" in this connection, as they have been used with so many different shades of meaning. Nevertheless, it is hard to find equivalents. The open system, indeed, has some similarities to the open system of von Bertalanffy, in that it implies that some kind of a structure is maintained in the midst of a throughput from inputs to outputs.[1] In a closed system, the outputs of all parts of the system are linked to the inputs of other parts. There are no inputs from outside and no outputs to the outside; indeed, there is no outside at all. Closed systems, in fact, are very rare in human experience, in fact almost by definition unknowable, for if there are genuinely closed systems around us, we have no way of getting information into them or out of them; and hence if they are really closed, we would be quite unaware of their existence. We can only find out about a closed system if we participate in it. Some isolated primitive societies may have approximated to this, but even these had to take inputs from the environment and give outputs to it. All living organisms, including man himself, are open systems. They have to receive inputs in the shape of air, food, water, and give off outputs in the form of effluvia and excrement. Deprivation of input of air, even for a few minutes, is fatal. Deprivation of the ability to obtain any input or to dispose of any output is fatal in a relatively short time. All human societies have likewise been open systems. They receive inputs from the earth, the atmosphere, and the waters, and they give outputs into these reservoirs; they also produce inputs internally in the shape of babies and outputs in the shape of corpses. Given a capacity

to draw upon inputs and to get rid of outputs, an open system of this kind can persist indefinitely.

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TWI2050 Report

The six transformations necessary to achieve the SDGs.

- **Substantial advances in human capacity are needed through further improvements of education and health care.** Education and health are instrumental for enabling people to live a self-determined life, find decent work and generate income to sustain themselves, but also to undertake climate change mitigation and deal with environmental problems. The ambitions go hand-in-hand with the goals to end poverty in all its forms and to reduce global inequality.
- **Responsible consumption and production cut across several of the other transformations, allowing us to do more with less.** Evidence shows that it is possible to reduce consumption of resources considerably by taking a more service and circular economy-oriented approach with respect to mobility, housing, food systems, and other sectors of our economies. Reductions in demand leverage large saving potentials at different stages of the supply chain.
- **It is possible to decarbonize the energy system while providing clean and affordable energy for all.** Pathway analysis shows that energy-efficiency, increasing the share of renewable energy, electrification and carbon-capture and storage all play a key role in decarbonizing the energy system around 2050, while providing access to modern energy for all. Achieving the Paris Agreement is still possible but only if combined with a focus on a broader set of SDGs.
- **Achieving access to nutritional food and clean water for all while protecting the biosphere and the oceans requires more efficient and sustainable food systems.** It is possible to meet the needs of a growing world population and at the same time limit the food system's environmental impacts by combinations of increasing agricultural productivity, reduction of waste and losses, and changes towards a less meat-intensive diet. The highest priority is to provide healthy and affordable food for all and thereby to eradicate hunger. Healthy diets and lifestyles are also essential for reducing obesity in the world.
- **Transforming our cities will benefit the majority of the world population.** Pathways show that by 2050 around two thirds of human population will live in urban areas. Sustainable cities are characterized by high connectivity and 'smart' infrastructure, enabling high quality services, with low environmental footprint. Transforming slums into decent housing is feasible with low energy and material requirements. Good city design, sustainable lifestyles, empowered local actors and participatory approaches that avoid one-size-fits all solutions are needed to achieve this transformation to sustainable cities.
- **Science, technology and innovations (STI) are a powerful driver but the direction of change needs to support sustainable development.** The digital revolution symbolizes the convergence of many innovative technologies, many of which are currently ambivalent in their contribution to sustainable development, simultaneously

supporting and threatening the ability to achieve the SDGs. There is an urgent need to bring the sustainability and the digital and technology communities together to align the direction of change with the 2030 Agenda and a sustainable future beyond. There is also a need to implement forward-looking roadmaps and governance structures that allow the mitigation of potential trade-offs of a STI revolution, particularly relating to its impact on the workplace, on social cohesion, and human dignity.

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From Jack Eddy SUN WEATHER Book:

Invited Speaker: Dr. Margaret Cavanaugh, Deputy Assistant Director, Geosciences (GEO) Directorate, National Science Foundation (NSF) To provide a "big picture" context, Dr. Cavanaugh began her remarks by quoting from President Obama's State of the Union address that as Americans, We need to out-innovate, out-educate, and out-build the rest of the world. She cited OSTP statements that **of all the challenges we face as a Nation and as a planet, none is as pressing as the three-prong challenge of climate change, sustainable development, and the need to foster new and cleaner sources of energy.**

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Scale. From MATHEMATICS FOR SUSTAINABILTY by John Roe and Russ DeForest

The Planet Walk honors Carl Sagan's work in science communication by giving visitors a direct sensory engagement with the size and shape of the solar system. In 2012 the Planet Walk was expanded. A monolith at the Astronomy Center of the University of Hawai'i now represents the nearest star to Earth—Alpha Centauri—on the same scale. Imagine walking the distance from Ithaca to Hilo, Hawai'i (where the Astronomy Center is located), to get some idea of the difficulties of interstellar travel compared to the journeys of our various spacecraft within the solar system.

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George Marshall. DONT EVEN THINK ABOUT IT: WHY OUR BRAINS ARE WIRED TO NOT THINK ABOUT CLIMATE CHANGE.

Why We Are Wired to Ignore Climate Change . . . And Why We Are Wired to Take Action Through our long evolution, we have inherited fundamental and universal cognitive wiring that shapes the way that we see the world and interpret threats and that motivates us to act on them. Without doubt, climate change has qualities that play poorly to these innate tendencies. It is complex, unfamiliar, slow moving, invisible, and intergenerational. Of all the possible combinations of loss and gain, climate change contains the most challenging: requiring certain short-term loss in order to mitigate against an uncertain longer-term loss. Climate change also challenges and reverses some deeply held assumptions. We are told that the way of life that we associate with

our comfort and the protection of our families is now a menace; that gases we have believed to be benign are now poisonous; that our familiar environment is becoming dangerous and uncertain. Our social intelligence is well attuned to keeping track of debts and favors, and ensuring equitable distribution of gains and losses. Climate change poses a major challenge here too, with all solutions requiring that rival social groups agree on a distribution of losses and thereafter the allocation of a greatly diminished shared atmospheric commons. We are best prepared to anticipate threats from other humans. We are inordinately skilled at identifying social allies and enemies, identifying the social cues that define loyalty to our group and that identify the members of rival out-groups. Climate change is immensely challenging in terms of these categorizations. It is not caused by an external enemy with obvious intention to cause harm. It therefore tends to be fitted around existing enemies and their perceived intentions: a rival superpower, big government, intellectual elites, liberal environmentalists, fossil fuel corporations, lobbyists, right-wing think tanks, or social failings such as overconsumption, overpopulation, or selfishness.

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TEACHING CLIMATE CHANGE IN THE HUMANITIES.

Chapter 19 The elephant in the room Acknowledging global climate change in courses not focused on climate by Scott Slovic

In *Numbers and Nerves: Information, Emotion, and Meaning in a World of Data* (2015), my father (psychologist Paul Slovic) and I discuss, in a somewhat more circumscribed and focused way than Marshall, a set of core psychological conditions and tendencies that complicate human sensitivity to a host of social and environmental concerns, ranging from genocide to climate change. ***In particular, we focus on psychic numbing, pseudoinefficacy, the prominence effect, and the asymmetry of trust. At the core of the Numbers and Nerves project is what we call “the psychophysics of brightness”: the simple fact that the human mind is tragically insensitive to large-scale phenomena.*** The change from one to two is more salient to us than the difference between thirty and thirty-one. By the time we’re talking about 350 or 400 ppm of carbon dioxide in the atmosphere, the numbers wash right past us, causing virtually no affective response. Social scientists have identified and attached names to these various mental processes, but **writers and artists have also intuited such cognitive limitations and have invented communication strategies (usually involving multidimensional combinations of abstract, quantitative overviews and salient, individualized narratives or “trans-scalar” movements between individual and collective representations of information) designed to strike home with audiences. This is where, for me, the prospect of effective teaching of climate change literature comes into play.**

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In book EXPOSED. Unpublished. UNLEARNING: A DIALOGUE talk by Eileen Joy [this may be a book review of this book TBD]

Eileen Joy writes, “Learning is always unlearning, a continual upending of everything you thought you knew, and therefore, difficult and melancholic,” and yet within the present as a “creatively productive fugitive zone . . . we might practice the arts of divergent, tapestried becomings.”[10] The “arts of divergent, tapestried becomings” beautifully describe the provisional practices of activists and artists analyzed in this book, as they engage with scientific data and schemas but resist the dominant impulse to externalize “the environment,” and instead participate within the immediate, layered worlds they inhabit.’.

In book EXPOSED. Unpublished. UNLEARNING: A DIALOGUE talk by Eileen Joy Judith (Jack) Halberstam describes *The Queer Art of Failure* as a book about “alternative ways of knowing and being that are not unduly optimistic, but nor are they mired in nihilistic critical dead ends. It is a book about failing well, failing often, and learning, in the words of Samuel Beckett, how to fail better.”[11] **The modes of environmental activism that are analyzed in Exposed could be dismissed as failures, in that they hardly halt the carbon economy, the clear-cutting of forests, the devastation of ocean environments, or the proliferation of plastics. But within the scale of the anthropocene, surely all activism, all politics, all ethics, and all government policies will have been colossal failures.** And yet, as Braidotti, insists, we nonetheless continue on, “for the hell of it”.

Many of the ostensible “failures” this book investigates certainly “fail better,” in that they are inventive, nuanced, impassioned, and intrepid. As a work of cultural studies, this analysis takes many popular and eccentric texts, artworks, films, and performances seriously, teasing out their complexities, and making sense of their embedded trajectories.”

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Elevated perspectives are problematic for both feminist and environmentalist visions, placing the human knower in a position above and beyond worldly entanglements.[15] Donna J. Haraway, in her now classic essay “Situated Knowledges,” critiques the “conquering gaze from nowhere,” the “view of infinite vision,” the “god trick” of an unmarked, disembodied perspective.[16] Such a perspective has become all too commonplace in the predominant visual depictions of the anthropocene, as I will argue in chapter 6. I have found it quite fruitful to return to this early essay by Haraway, as twenty-first-century environmental, economic, and geopolitical panic has amplified the faith in floating perspectives—disembodied systems that can objectively map and maintain “resources” for some abstract global human subject of the present and future. Haraway contends that “feminist objectivity is about limited location and situated knowledge, not about transcendence and splitting of subject and object. In this way we might become answerable for what we learn how to see.”[17] Many of the chapters that follow critique transcendence and the splitting of the subject and the object, countering this stance with alternative formulations of new materialist exposure. My conception of trans-corporeality was no doubt influenced by Haraway’s feminist

epistemology, as trans-corporeality originates with a recognition of the self as solidly located and denies the splitting of subject and object: the subject, the knower, is never separate from the world that she seeks to know. But that conception of positionality was deeply materialized through the process of editing (with Susan Hekman) *Material Feminisms* and writing *Bodily Natures*. [18] Drawing on Karen Barad's theory, I developed a conception of the trans-corporeal subject who is "situated" in a more material manner, as the very substances of the world cross through her, provoking an onto-epistemology that reckons, in its most quintessential moments, with self as the very stuff of the emergent material world. Since transcendent epistemologies have fueled environmental destruction and harm to wild, domesticated, and laboratory animals, attention to the relation between epistemology and ethics remains vital.

Barad's formulation of "ethico-onto-epistem-ology" calls us to consider the "intertwining of ethics, knowing, and being." [19] Indeed, her theory of agential realism makes epistemology an ontological matter. And, like many of the artists and activists analyzed in *Exposed*, Barad insists that humans "are part of the world-body space in its dynamic structuration," and that the "becoming of the world is a deeply ethical matter." [20]

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Taking such "stuff" seriously mixes up the domain of ethics (primarily personal) and the domain of politics (primarily public), leaving us with something not unlike the feminist contention that the personal is political. A material feminist or new materialist environmentalism, however, would stress that the material interchanges between bodies, consumer objects, and substances become the site for ethical-political engagements and interventions. *Ethics and politics flow into each other, as the empty imaginary space for rational political debate becomes full to overflowing with all sorts of weirdly quotidian things that one would not expect to be there—plastic bags, cell phones, pesticides, bicycles, mercury-laden tuna. The public sphere needs to be reckoned with as if it were a landfill. If, as Barad contends, "the becoming of the world is a deeply ethical matter," [24] that formulation could not be any more political than it already is, for inquiry into the nature of what is good must proceed to ask what is the world becoming and for whom? If the domains of the ethical and the political, the personal and the public, the domestic and the global, have collapsed into each other, they also reach across the unthinkable scale of the anthropocene as climate change, ocean acidification, extinction, and the production of xenobiotic chemicals make the location of each person's ethics and politics extend through vast geographical and temporal expanses, affecting countless species.*

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Cohen notes, in *Stone: An Ecology of the Inhuman*, that the "ecological project of thinking beyond anthropocentricity requires enlarged temporal and geographical scales," yet "expanded frames risk emphasizing separations at the expense of material intimacies." [25] Many of the artists, writers, theorists, and activists that appear throughout *Exposed* endeavor to stretch material intimacies across immense scales.

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The relation between ethics and politics is a question that comes with such long histories that it cannot be resolved here. Nonetheless, it may be useful to point out that **posthumanist new materialism, trans-corporeality, and some modes of environmental activism muddle the categories of the ethical and the political, not only because they insist that nonhuman life is a matter of concern but because they demonstrate that even the smallest, most personal ethical practices in the domestic sphere are inextricably tied to any number of massive political and economic predicaments, such as global capitalism, labor and class injustice, climate injustice, neoliberalism, neocolonialism, industrial agriculture, factory farming, pollution, climate change, and extinction. *The ethical and the political, like many other questions of and in the anthropocene, become matters of scale-shifting—improvisational interventions in lives and worlds where there is no stable background and nothing can be set straight. The mess we find ourselves in* is perhaps most beautifully articulated by Stephanie LeMenager in her analysis of petrocultures, **where even media—vehicles for the experience of “liveness”—are utterly reliant on oil: “We experience ourselves, as moderns and most especially as modern Americans, every day in oil, living within oil, breathing it and registering it with our senses. The relationship is, without question, ultradeep.”** [26] Such saturated life worlds call for immersive practices and methodologies rather than dry, detached assertions.**

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WRITING OIL chapter in LIVING OIL book by Stephanie LeMenager

The modern energy that focuses my efforts is petroleum energy, and in the word “petroleum” I intend a diversity of nonsolid hydrocarbon resources, including natural gas and, more consistently, oil. This is a book about contradictory emotions because it is a book about petroleum culture, by which I mean petroleum media, by which I mean the objects derived from petroleum that mediate our relationship, as humans, to other humans, to other life, and to things. It is a book of environmental cultural studies, driven by a fascination with petroleum aesthetics. Here the word “aesthetic” derives meaning from its most basic etymological root in how we sense and perceive, and from what have been called ideologies of the aesthetic, forms of representation and value expressed by means of display, spectacle, concealment, and stealth. **We experience ourselves, as moderns and most especially as modern Americans, every day in oil, living within oil, breathing it and registering it with our senses. The relationship is, without question, ultradeep. There can be no “liveness” without mediation**, as Philip Auslander has argued passionately and convincingly, making both the historical point that “mediatization is now explicitly and implicitly embedded within the live experience”—for example, we experience only “miked” voices as natural in the theater—and the ontological point that “liveness” has always been a relative term, not a pristine category. Let me particularize Auslander’s argument to say that liveness, as in seeming to be alive, now relies heavily upon oil. **Oil itself is a medium that**

fundamentally supports all modern media forms concerned with what counts as culture—from film to recorded music, novels, magazines, photographs, sports, and the wikis, blogs, and videography of the Internet. Many more cultural forms indebted to oil can be named, and they will be throughout this book. Can the category of the human persist, practically speaking, without such forms indebted to fossil fuels?

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In the 1990s, Amitav Ghosh offered what has turned out to be the most influential first critique of “petrofiction,” fiction about oil. In a review of the book *Trench* by the Saudi writer Abdelrahman Munif, who is known for the quintet of oil novels *Cities of Salt*, Ghosh laments that literary writing, in particular the novel, balks at the oil encounter. He notes the novel’s preference for monolingual speech communities, its attachment to place, and its interest in separate “societies.” According to Ghosh, these genre tendencies are unsuited to the “bafflingly multilingual” and “intrinsically displaced, heterogeneous, and international” world of oil. Following Ghosh, the cultural critic Imre Szeman provides a more comprehensive explanation of why literature hasn’t dismantled our self-subjection to oil capital. “Instead of challenging the fiction of surplus—as we might have hoped or expected—literature participates in it just as surely as every other social narrative in the contemporary era,” Szeman argues.

The question of how to write about the oil encounter has plagued novelists and critics, particularly those frustrated by what Szeman describes as the Left’s failure to generate alternatives to oil capital at a moment when the dwindling of conventional oil reserves might tip us toward Tough Oil or toward a more sustainable future. I share this frustration. It is an unsurprising representational and critical morass, given the ultradeep relationship between we moderns and oil. As will become clear, I’m not seeking a literary ace in the hole or novel that writes oil as it is, “intrinsically displaced, heterogeneous, and international.” Szeman and a dynamic group of self-named “petrocritics” have begun to archive potential candidates for this best, most representationally astute oil novel.

But compelling oil media are everywhere. Films, books, cars, foods, museums, even towns are oil media. The world itself writes oil, you and I write it. Petrofiction provides one route to understanding our entanglement. So does everything else. As a critical essayist, my challenge has been to find a point of view from which to frame the everything of oil. Each chapter of this book tries out (essayer) our investments, my investments, in a profoundly unsustainable and charismatic energy system. This is a short cultural history of, essentially, destructive attachment, bad love. The question of how to discuss an unsustainable attachment to nearly everything sent me looking for models in environmental writing.

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As in my first book about *charismatic and unsustainable commodities, Manifest and Other Destinies* (2005), here I argue that the **transnational, as the fundamental if elusive space of economic globalization, tends to be most visible in regional sites**

*of capital production and transshipment. Commodity regionalism activates vital historical and ecological frames, opening an explicit point of view onto global-scale forces and flows, such that we can see and sense them. The regional frame assists, too, in the pursuit of the psychologically ultradeep, the affects and emotions lodged in gasoline fuel, cars, and in the thousands of everyday items made from petroleum feedstock, from lip balms to tampon applicators, dental polymers, and aspirin tablets. As Stacy Alaimo writes in a criticism of sustainability rhetoric that focuses on maintaining modern lifestyles, “rather than approach this world as a warehouse of inert things we wish to pile up for later use, **we must hold ourselves accountable to a materiality that is never merely an external, blank, or inert space but an active, emergent substance of ourselves and others.**” What Alaimo calls “an ethics of mattering” becomes particularly complex, sticky, when it comes to petroleum. **We wear and eat it. Our bodies write it.***

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WHY CAN'T OBAMA ARTICULATE HIS ENERGY STRATEGY?

The president's all-of-the-above approach to oil, gas, coal, wind, solar and everything else has been comprehensive, but incomprehensible.

LISA MARGONELLI · OCT 31, 2012

When President Obama says his energy strategy is “all of the above,” I cringe. The statement is hardly inaccurate: pushing every kind of energy from nuclear to natural gas and oil to solar, wind, energy efficiency, and grid upgrades is exactly what he’s done during his term. What I dislike is that the president is missing an opportunity to tie all the stuff he’s doing into a grander strategy to decrease carbon emissions, give Americans control over their energy spending, and sustain long-term economic growth. “All of the above,” is using a lame-ish crutch where Obama could be using a sword (or at least a laser) to point towards a future where reducing carbon emissions and having a vibrant economy go together. This is crucial to passing legislation in the U.S. and getting India and China on board.

Reducing carbon emissions and sustaining or accelerating economic growth is not a controversial idea in the business community. In 2008, McKinsey, the global business consultancy, estimated that the world could reduce carbon emissions by creating a new Industrial Revolution focused on energy and carbon productivity for well under half the amount of money (in GDP terms) that global spending on insurance.

This revolution in productivity would be like experiencing the Industrial Revolution in triple time—full of extraordinary opportunities and risks, too.

Second Margonelli article on termites, in Scientific American. Copied to iBooks

In the end, the mounds look like a patchwork of **hexagons**, maximizing the distance between every mound. This made sense: many other creatures have **self-organized hexagonal territories**, including wolves, Alaskan sandpipers and even some kinds of fish.

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Trajectories of the Earth System in the Anthropocene

<https://www.pnas.org/content/pnas/115/33/8252.full.pdf>

Will Steffena,b,1, Johan Rockströma, Katherine Richardsonc, Timothy M. Lentond, Carl Folkea,e, Diana Livermanf, Colin P. Summerhayesg, Anthony D. Barnoskyh, Sarah E. Cornellai, Michel Crucifixij, Jonathan F. Dongesak, Ingo Fetzerl, Steven J. Ladea,b, Marten Schefferl, Ricarda Winkelmannk,m, and Hans Joachim Schellnhuberak,m,1

Edited by William C. Clark, Harvard University, Cambridge, MA, and approved July 6, 2018 (received for review June 19, 2018)

We explore the risk that self-reinforcing feedbacks could push the Earth System toward a planetary threshold that, if crossed, could prevent stabilization of the climate at intermediate temperature rises and cause continued warming on a “Hothouse Earth” pathway even as human emissions are reduced. Crossing the threshold would lead to a much higher global average temperature than any interglacial in the past 1.2 million years and to sea levels significantly higher than at any time in the Holocene. We examine the evidence that such a threshold might exist and where it might be. If the threshold is crossed, the resulting trajectory would likely cause serious disruptions to ecosystems, society, and economies. Collective human action is required to steer the Earth System away from a potential threshold and stabilize it in a habitable interglacial-like state. Such action entails stewardship of the entire Earth System—biosphere, climate, and societies—and could include decarbonization of the global economy, enhancement of biosphere carbon sinks, behavioral changes, technological innovations, new governance arrangements, and transformed social values.

Earth System trajectories | climate change | Anthropocene | biosphere feedbacks | tipping elements

[This may be take two with more details and opening]

PERSPECTIVE

Trajectories of the Earth System in the Anthropocene

Will Steffena,b,1, Johan Rockströma, Katherine Richardsonc, Timothy M. Lentond, Carl Folkea,e, Diana Livermanf, Colin P. Summerhayesg, Anthony D. Barnoskyh, Sarah E. Cornellai, Michel Crucifixij, Jonathan F. Dongesak,

Ingo Fetzer^a, Steven J. Ladeau^b, Marten Scheffer^c, Ricarda Winkelmann^d, and Hans Joachim Schellnhuber^{a,k,m,1}

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Earth System trajectories | climate change | Anthropocene | biosphere feedbacks | tipping elements

The Anthropocene is a proposed new geological epoch (1) based on the observation that human impacts on essential planetary processes have become so profound (2) that they have driven the Earth out of the Holocene epoch in which agriculture, sedentary communities, and eventually, socially and technologically complex human societies developed. The formalization of the Anthropocene as a new geological epoch is being considered by the stratigraphic community (3), but regardless of the outcome of that process, it is becoming apparent that Anthropocene conditions transgress Holocene conditions in several respects (2). The knowledge that human activity now rivals geological forces in influencing the trajectory of the Earth System has important implications for both Earth System science and societal decision making. While recognizing that different societies around the world have contributed differently and unequally to pressures on the Earth System and will have varied capabilities to alter future trajectories (4), the sum total of human impacts on the system needs to be taken into account for analyzing future trajectories of the Earth System. Here, we explore potential future trajectories of the Earth System by addressing the following questions.

Is there a planetary threshold in the trajectory of the Earth System that, if crossed, could prevent stabilization in a range of intermediate temperature rises?

Given our understanding of geophysical and biosphere feedbacks intrinsic to the Earth System, where might such a threshold be?

If a threshold is crossed, what are the implications, especially for the wellbeing of human societies?

What human actions could create a pathway that would steer the Earth System away from the potential threshold and toward the maintenance of interglacial-like conditions?

Addressing these questions requires a deep integration of knowledge from biogeophysical Earth System science with that from the social sciences and

humanities on the development and functioning of human societies (5). **Integrating the requisite knowledge can be difficult, especially in light of the formidable range of timescales involved. Increasingly, concepts from complex systems analysis provide a framework that unites the diverse fields of inquiry relevant to the Anthropocene** (6). Earth System dynamics can be described, studied, and understood in terms of trajectories between alternate states separated by thresholds that are controlled by nonlinear processes, interactions, and feedbacks. Based on this framework, we argue that social and technological trends and decisions occurring over the next decade or two could significantly influence the trajectory of the Earth System for tens to hundreds of thousands of years and potentially lead to conditions that resemble planetary states that were last seen several millions of years ago, conditions that would be inhospitable to current human societies and to many other contemporary species.

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PLACES TO INTERVENE IN A SYSTEM by **Donnella Meadows 1st draft**

(in increasing order of e

9. Constants, parameters, numbers (subsidies, taxes, standards).
8. Regulating negative feedback loops.
7. Driving positive feedback loops.
6. Material
5. Information
4. The rules of the system (incentives, punishments, constraints).
3. The distribution of power over the rules of the system.
2. The goals of the system.
1. The mindset or paradigm out of which the system — its goals, power structure, rules, its culture — arises.

Leverage Points: Places to Intervene in a System
By Donella Meadows~. document in BOOKS

Here, in the light of a cooler dawn, is a revised list:

PLACES TO INTERVENE IN A SYSTEM

(in increasing order of e

12. Constants, parameters, numbers (such as subsidies, taxes, standards).
11. The sizes of bu
9. The lengths of delays, relative to the rate of system change.
8. The strength of negative feedback loops, relative to the impacts they are trying to correct against.
7. The gain around driving positive feedback loops.
6. The structure of information
5. The rules of the system (such as incentives, punishments, constraints).
4. The power to add, change, evolve, or self-organize system structure.
3. The goals of the system.
2. The mindset or paradigm out of which the system — its goals, structure, rules, delays, parameters — arises.
1. The power to transcend paradigms.

To explain parameters, stocks, delays, fl
 [see diagram in BOOKS document]

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THE POSITIVE DEVIANT by Sara Parkins

And so it is with climate change. The end-of-pipe mentality has got governments obsessing about CO2 once it has been emitted and ‘permits to pollute’ that may be traded. **To go upstream to prevent carbon from being mobilized in the first place, and to squeeze all waste out of what we do use, strikes a dagger blow to the perverse logic on which we have built our economy. Less may be more for the environment and even the quality of our life, but it is death to the way the current economy works.** Whether in the form of kit to plug onto the end of your pipe or CO2 emission permits to buy and sell, where there is muck there is a great deal of brass to be made. Consequently, governments are in a fret about more than the loss of some corporation tax from a few large energy generators, they are gripped by an icy dread of

an imploding economy. *Reflect for a moment on the 3 per cent drop in greenhouse gas emissions credited to economic recession in 2008. That was from fossil fuel energy and other resources not used, widgets not made, thermostats turned down and journeys not taken.*

As well as being trapped by the perversity of what constitutes economic growth, policy makers struggle to imagine the wider benefits of shifting to low-carbon lifestyles, so don't allocate money most effectively. **This is partly because of poor knowledge about the physics of resource use and partly because of the segregated way policy is made and implemented.** Legislators and their civil service find it hard to see that there are many more health and other crossover social benefits, like jobs and innovation, as well as climate change gains to be had in less resource use, than there are in trying to keep things going as they are now. Running nuclear power stations, cleaning up pollution or policing CO2 trading schemes offer few, unattractive jobs devoid of entrepreneurial opportunity.

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Wands, sadly, are in short supply for even the most ambitious positive deviant so we are at the beginning of what James Galbraith calls 'a long, profound, painful and irreversible process of change [and] we need to start thinking and acting accordingly'.¹⁰ Either we make the transition to an ecological economy in as planned and orderly a way as possible, or the environment and (increasingly likely) social disorder will do it for us –suddenly and probably brutally. **The job of positive deviants, therefore, is to preempt this eventuality and convince others that doing right by the environment and people can be the motor of a perfectly satisfactory economy.**

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HOW BAD ARE BANANAS? By M. Berhners-Lee

What does a ton of CO₂e look like? If you filled a couple of standard-sized 60-gallon garden water tanks to the brim with gasoline and set fire to them, about a ton of carbon would be directly released into the atmosphere. (The carbon footprint of burning that gas by driving is a bit more than that, for reasons explained later.) If you did the same with two cups of gas, that would release just over a kilogram (2 pounds) of carbon dioxide, and if you burned a blob about the size of a chickpea, that would release about a gram. There are a thousand grams in a kilogram and roughly a thousand kilograms in a ton.

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Liberation Science: Putting Science to Work for Social and Environmental Justice by Steven H. Emerman, Marcia Bjørnerud, Jill S. Schneiderman, Sarah A. Levy

3 customer reviews

Liberation Science is the practice of using the knowledge and methods of science to solve the social and environmental problems faced by the poor. Liberation Science can

address these problems because it has been freed from the flawed scientific paradigms that are linked to the flawed social paradigms of nationalism and capitalism. Three themes of Liberation Science are:

- 1) The definition of an ecosystem becomes both more expansive and more holistic to include humans, cultural practices, and the built environment, together with the possibility that an ecosystem could mimic the behavior of a single organism.
- 2) The logic and methods of science are made available to ordinary people, empowering them to understand the ecologies of their own communities.
- 3) Science becomes open to complementary philosophical approaches that draw upon cultural and spiritual traditions of particular regions or communities.

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This is important because in an age of instant connectivity and contracted attention spans, it is now even more difficult to draw attention to the violence of environmental degradation.

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It is time to rethink the scientific hierarchy and recognize that the time-entangled sciences are just as fundamental as—and arguably more important from the standpoint of human well-being—than those that a priori exclude the particulars of history. We need to embrace rather than deny the “historicity” that makes natural systems so rich—and so incredibly complicated.

environmental scientist John Harte (2002) has argued eloquently for a new kind of science that merges Newtonian thinking (idealized, ethereal, timeless) with Darwinian (organic, earthy, evolutionary). Historian Peter Turchin (2008) goes further, suggesting that the field of history transform itself into a quantitative science—modeled after geology and evolutionary biology—that seeks patterns of causality in the vigor or decline of societies, while also respecting the singularity of any moment in time.

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In societies too, a sense of individual accountability can be eroded by political and economic systems whose opacity and anonymity disempower people by obscuring causal connections between actions and their results. Globalization of the world economy has distanced us from the sources of the commodities we use. Digital technologies subtly undermine our tactile, instinctual connection to the physical world by making actions “virtual” and by reducing decisions, small and large, ethical or immoral, to mouse clicks. Modern infrastructures that make life easier, safer, and sweeter smelling—food distribution networks, electrical grids, sewage systems—also act as physical euphemisms that mask the dirty consequences of our daily habits and allow us to go about our business with unnaturally clean consciences. With environmental cause and effect as disconnected as they are today, we are at risk of becoming a “Dorian Gray” society in which the ugly manifestations of our lifestyles are stored out of sight—typically transferred to less affluent communities and future generations—while we carry on with the free trade bacchanal.

We need a better sense of temporal proportionality: to consider carefully whether the benefit we derive from extracting and consuming a commodity is commensurate with the time it will take to heal any environmental damage done over its life cycle.

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From Scranton, Roy. Learning to Die in the Anthropocene. Pages 31-37 THIS IS THE WHOLE STORY THROUGH TIME OF SHIFTING TO COAL FROM PHOTOSYNTHESIS OVER 100,000 PLUS YEARS. = [Note from Ben: This [section below] is the most I have copied out of any book. =Well, that's that. A note here I can see from these few pages of storytelling that I am needing to find ways to speak to this and so many worlds away from the conversations of the 4th Industrial revolution. It was closer when sustainability was central, now it is about developing through this. Time to have DRAWDOWN as The Central measuring stream to drive things.]

This cold drought lasted four centuries before the Gulf Stream switched on again. In the marshy confluence of the Tigris and Euphrates rivers, farmers began constructing irrigation canals to control flooding and increase crop yields. Villages grew into towns, and as the people living in these new towns struggled to deal with the complex, difficult group effort required to construct and maintain levee systems, keep records of floods and farm yields, and bring in the harvest, they began to develop refined divisions of labor, hierarchical political structures, sophisticated religions, and writing. Temples and marketplaces were built, traders carried goods from one town to another, and priests accumulated power as they hoarded knowledge of weather patterns and seed growth. The settlements of Ur, Eridu, and Uruk grew from clusters of villages to immense cities of tens of thousands. Through a complex interplay of droughts, population growth, and the increasing centralization of agriculture, human society based in and around cities—what we call “civilization”—emerged in the fertile crescent of land arcing from present-day Lebanon through Syria and Iraq to the Persian Gulf. From approximately 3100 to approximately 2200 BCE, Sumerian and then Akkadian kings ruled a vibrant collective form of life that stretched across Mesopotamia. But when a three-hundred-year-long drought hit the region, that vibrant empire fell apart.

Mighty Uruk stood desolated.

From ancient Uruk to modern-day Iraq we span about five thousand years, including nearly all of recorded human history—the Greeks, the Romans, the Tang dynasty, the Mongolian khanate, World War II, the invention of the cellphone, and all seven seasons of Mad Men. If human existence on Earth were a day, our approximately five millennia of recorded history would take up the last half hour before midnight. Throughout 99.9 percent of humanity's two hundred thousand years on Earth, the average planetary temperature never rose above 61 degrees Fahrenheit and carbon dioxide concentrations never went above 300 parts per million (ppm). Nearly all of our energy came from photosynthetic processes: most of our fuel was plant food, for ourselves directly, through the animals we used and preyed on, or through biomass like wood, with some use of water and air power through technologies like mills and sails, and negligible use of coal and oil.

Then, in 1781, James Watt invented the continuous-rotation steam engine. Suddenly power was portable, independent of living beings or natural forces, and able to run continuously. The steam turbine offered a vast improvement in energy production over wind, water, and animal labor, but it needed dense, hot-burning fuel for maximum output. Luckily for Watt, there happened to be loads of the stuff all over England: fossilized carbon in the form of coal.

Industrial coal changed everything. For the last two hundred years, just about one tenth of one percent of human existence, most of our energy has come not from direct photosynthesis but from stored carbon energy in fossil fuels. Switching from a photosynthetic-based energy economy to a carbon-based energy economy increased human wealth beyond what anyone could have possibly imagined, raising the overall standard of living across the world through such technologies as diesel-fueled tractors, Haber-process nitrogen-fixed fertilizer, Bessemer steel, railroads, steamships, airplanes, electric power plants, plastics, the internal combustion engine, and the automobile. It also began a massive transformation of the physical systems regulating life on Earth. By transferring millions of tons of carbon from the ground into the air, we have wrought profound changes in the Earth's climate, biosphere, and geology. Average atmospheric CO₂ levels have rocketed from 290 ppm to over 400 ppm, a level the planet hasn't seen in more than two million years. At the same time, methane (CH₄) levels have increased from 770 parts per billion to more than 1,800 parts per billion, the highest concentration of atmospheric methane in at least eight hundred thousand years. ³⁷ These changes have disrupted the climate patterns regulated by the Earth's orbit around the Sun and will continue to disrupt them for thousands of years.

Our planet can sustain life because when energy from the Sun strikes the Earth, some of it is trapped in the atmosphere as heat. There are several greenhouse gases that help this happen, including carbon dioxide, methane, water vapor, and nitrous oxide. These gases are integral to the planet's complex geophysical homeostasis. That homeostasis has shifted, over millions of years, back and forth between "greenhouse" and "icehouse" states. During the last major greenhouse state, in the Eocene, the planet was ice-free, tropical from pole to pole, up to 20 degrees Fahrenheit warmer than it is now, and had CO₂ concentrations up to ten times those of today. The oceans were 300 feet higher. Large reptiles and dwarf mammals ranged through lush forests: a forty-foot-long snake that weighed more than a ton, a tiny horse the size of a dog, sleek feline predators, and lemur-like primates. Crocodiles and palm trees thrived along the Arctic Circle. That was fifty million years ago. Since then, the Earth has cooled, and it has been in an "icehouse" state for more than two and a half million years. We have very likely brought that state to a premature end.

For the first sixty thousand years of Homo sapiens' life on Earth, global temperatures 5 to 9 degrees Fahrenheit colder meant an ice sheet covering what is now Chicago and New York. That same amount—5 to 9 degrees Fahrenheit—is about as much as the planet is expected to warm up over the next few generations, and it doesn't sound like a lot. After all, the temperature changes more than that every day, and frequently much more, depending on season and locale. But when you're talking about planetary

averages, those differences are enormous. A future 5 to 9 degrees Fahrenheit warmer will mean the Arctic Ocean will be ice free in the summer. Mountain glaciers will all but disappear, and with them, skiing, snowpack and a great many freshwater streams. Freak weather will play havoc with agricultural systems, plant and animal habitats, and human infrastructure. We'll have to contend with more extreme temperature fluctuations, more humidity, more and more intense rainfall, stronger and longer-lasting storms, severe droughts, and unpredictable changes in formerly reliable climate dynamics, such as the jet streams, the El Niño southern oscillation, and the Gulf Stream. Coral reefs will go extinct, along with countless other species caught in ecosystems changing too swiftly for them to adapt to or migrate out of.

More important, warming of 5 to 9 degrees Fahrenheit will eventually lead to sea levels 90 to 200 feet higher. No one is sure how quickly that will happen: If the ice melts slowly, we might only see a few feet of sea level rise by 2100. If the ice melts quickly and the Greenland ice sheet collapses, we could witness seas 20 to 30 feet higher within decades. Ice sheets are already melting faster than models have predicted, there is evidence that they have broken apart very quickly in the past, and ice melt is a feedback phenomenon, meaning that the more ice that melts, the faster the remaining ice melts. These factors mean that a rapid, unpredictable rise in sea level is all too possible. According to James Hansen, "the empirical data show us that natural ice sheet disintegration can be rapid, at rates up to several meters of sea level rise per century." 38 Whether it happens slowly or quickly, sea level rise will be disastrous for modern civilization: hundreds of millions of people living in low-lying coastal cities will be threatened not only by floods, but also by the increased storm surges resulting from the combination of higher seas, a wetter climate, and stronger storms.

It gets worse. Global warming of 5 to 9 degrees Fahrenheit depends on "business as usual," but there are very good odds that business will not go as usual. Growing populations and surging carbon consumption, particularly in China and India, will mean that the amount of carbon waste being produced is likely to increase over the next eighty-five years, as it has increased over recent decades. Feedback dynamics in the global climate system will likely raise temperatures even faster. Melting permafrost in Canada and Siberia will significantly increase atmospheric carbon dioxide and potentially increase warming by up to 80 percent. 39 And, as mentioned before, methane hydrates frozen in permafrost and locked in sediments at the bottom of the ocean could "belch," superheating the Earth and likely making it uninhabitable for the primate *Homo sapiens*.

Our hominid ancestors evolved during a period of general planetary cooling, and humans themselves evolved in a glacial climate colder than the one we live in today. Civilization as we understand it developed during what has been an unusually long and mild interglacial period, beginning around 10,000 BCE and continuing into the recent past. After the icy millennia of the late Pliocene, the Holocene was a kind of Eden, and being the clever, adaptable animals that we are, we took advantage of it. Human civilization has thrived in what has been the most stable climate interval in 650,000 years. 40 Thanks to carbon-fueled industrial civilization, that interval is over.

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From PLAYING WITH TIME As if the World Matters. By Lucy Neal

Perhaps, as described by climate scientist Mike Hulne, the uncomfortable reality that none of the global deployments of science, economics, international relations, diplomacy and politics have yielded the breakthrough needed on the global stage, needs to be faced: 'Perhaps this particular way of framing climate change (as a mega-problem awaiting, demanding a mega-solution) has led us down the wrong road. By constructing climate change as the "mother of all problems" –perhaps we have out-manoeuvred ourselves.'

Why We Disagree About Climate Change

Lucy R. Lippard, writer, art critic and activist talks of art as a 'framing device for visual and/ or social experience' and describes how artists 'slip between the institutional walls to expose the layers of emotional and aesthetic resonance in our relationships to the world'. She points out how the immensity of the topics being faced today require the space or place for encounter to be redefined, to present a set of multiple views.

The frame of life on Earth is being rapidly redrawn and the need for multiple views is paramount. With a coolly distant nod to the Futurists' welding of art, science and technology, a number of British-based cultural organizations have astutely drawn these disciplines together to manage a space where mutual dialogue can happen and where creative outcomes to the conundrum of climate change can be explored and shaped by artists with a wealth of expertise in a place of equal participation.

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From THERE IS NO PLANET B by Mike Benners-Lee

What is Ocean Acidification and why does it matter? Caused by CO2 and potentially just as nasty as climate change.

Described by Jane Lubchenco, former head of the National Oceanic and Atmospheric Administration, as global warming's equally evil twin⁷, this oddly gets less than 5% of the coverage of climate change. The basic story is that CO₂ from burning fossil fuel finds its way into the ocean and the resulting acidification reduces the ability of sea life to produce shells and skeletons⁸. Any species that takes a hit passes on the pain to all those who like to eat it. Thomas Lovejoy (former chief biodiversity advisor to the World Bank) described it as 'like pulling the rug out from under the marine food chain'⁹ and the potential result is catastrophic collapse of marine life. Once this happens it is almost certainly be incredibly difficult to reverse. Our loss of sea food would be just one of the enormous consequences.

Why doesn't this get the air time that climate change enjoys? Probably because everyone is so exhausted debating climate change that their energy has run out. And

perhaps because the impacts might seem even more abstract than the idea of climate change, which at least includes things we can imagine like floods and ice shelves collapsing. We get exhausted with bad news and problems. Luckily the solution to this one pops out of the hat as we deal with climate change, so its effect on our thinking can mainly be to double the motivation to get off our butts.

Footnotes

Energy Chapter 3 footnote #6 The Earth has a cross section of 1.274×10^{14} m² and the solar constant (sun incident per m², perpendicular) is 1361 W/ m², so 1.74×10^{17} W in total. But 30% is reflected, leaving about 953 W/ m² or 1.22×10^{17} W total. With 7.5 billion people, this leaves 16,277 kW per person or 391,000 kWh per person per day, compared to our use of 59 kWh per person per day. So we use one 6621th.

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Imagination is a cornerstone of peak oil media, which emphasizes the importance of narrative and art in moving beyond the Age of Oil. In their attempt to liberate the modern world from oil dependency, peak oilers have excelled in delineating the philosophy of taste that complements the fossil fuel regime. They bring to light the aesthetics of petroleum in their attempts to create new structures of feeling. On YouTube, Rob Hopkins, founder of the Transition Network for a sustainable post-oil future, urges us to remember that, although oil may be running out, imagination is not. "There's no reason that the imagination and ingenuity that got us up to the top of the peak in the first place is going to disappear when we have to start figuring out how we're going to get down the other side." Peak oiler James Howard Kunstler vividly represents modes of fabrication not reliant on petroleum infrastructures in his post-oil novel *World Made by Hand* (2008). For example: "Larry Prager was our dentist. With the electricity off most of the time, he did not have the high speed drill anymore. He got ahold of a 1920s pulley drill in Glens Falls, and Andrew Pendergast helped him rig it up to a foot treadle which Sharon could operate like a pump organ as she assisted her husband." Kunstler's bricoleurs animate a sentiment of hope within a future of diminished resources, just as Hopkins's "transition tales," which he tells to adults on YouTube and to children in public libraries, intend to create feasible, if imaginary, infrastructures for worlds powered by renewable energy.

As Frank Kaminski argues in the first critique of post-oil fiction, post-oil authors recognize that people need "to be moved emotionally, as well as through their senses."

I concur that the narrative arts will be key actors in establishing the ecological resilience of the human species.

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LIVING OIL by Stephanie Lemenager

from "Living Oil: Petroleum Culture in the American Century (Oxford Studies in American Literary History Book 5)" by Stephanie LeMenager

The social problem of forgetting the risks of oil extraction implies the aesthetic problem of how media incites or fails to incite protest, policy making, and other redemptive action. Debates that have raged in cultural criticism for decades, entering what now appears as a classic phase in Susan Sontag's and John Berger's writings on photography in the 1970s, resurface in chapter 1 in close examinations of oil spill media—including photography, magazines, film, blogs, and print books.

Like contemporary critics such as Maggie Nelson, I am skeptical about the relay of media → empathy → action that some of my fellow defenders of the arts and humanities would like to take for granted. When the director of a documentary film stated to a live audience that he had done his job by depicting the decimation of Gulf Coast fishing one year after the BP spill so as to create empathy, and the rest was left to us, the theater emptied. His film is important, and the effort to create it on a shoestring budget heroic. **Yet empathy attaches to no particular plan of action, as Sontag acknowledged, and it may even paralyze us in a shameful realization of the inaccessibility of political power,** as Berger noted from the depths of the Vietnam War. Nonetheless, like Sontag in *Regarding the Pain of Others*, I want the images to keep coming. Environmental media plays a crucial role in archiving, which is a means of measuring loss. As Lawrence Buell has argued, without environmental media we might not know either the extent of modern ecological injury or the baseline of ecological health by which to measure the damage. These media also generate sociability, by which I mean association for the sake of being together, a social form related to art and to play. Both survivors and spectators of ecological crisis have been made excruciatingly aware of their exclusion from managed resource commons that, as the historian Peter Linebaugh argues, ought to exist as a fundamental right of modern citizenship from the time of the second charter of the Magna Carta. **The social has proven more difficult to privatize than situated resources,** as has been shown, for example, by Internet protest communities responding to the BP spill or creating the Occupy movement in the United States, with its debts to the Egyptian protestors who staged a revolution on Facebook and in Tahrir Square.

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The modern energy that focuses my efforts is petroleum energy, and in the word “petroleum” I intend a diversity of nonsolid hydrocarbon resources, including natural gas and, more consistently, oil. This is a book about contradictory emotions because it is a book about petroleum culture, by which I mean petroleum media, by which I mean the objects derived from petroleum that mediate our relationship, as humans, to other humans, to other life, and to things. It is a book of environmental cultural studies, driven by a fascination with petroleum aesthetics. Here the word “aesthetic” derives meaning from its most basic etymological root in how we sense and perceive, and from what have been called ideologies of the aesthetic, forms of representation and value expressed by means of display, spectacle, concealment, and stealth. We experience ourselves, as moderns and most especially as modern Americans, every day in oil, living within oil, breathing it and registering it with our senses. The relationship is, without question, ultradeep. There can be no “liveness” without mediation, as Philip

Auslander has argued passionately and convincingly, making both the historical point that “mediatization is now explicitly and implicitly embedded within the live experience” —for example, we experience only “miked” voices as natural in the theater—and the ontological point that “liveness” has always been a relative term, not a pristine category. Let me particularize Auslander’s argument to say that liveness, as in seeming to be alive, now relies heavily upon oil. Oil itself is a medium that fundamentally supports all modern media forms concerned with what counts as culture—from film to recorded music, novels, magazines, photographs, sports, and the wikis, blogs, and videography of the Internet. Many more cultural forms indebted to oil can be named, and they will be throughout this book. Can the category of the human persist, practically speaking, without such forms indebted to fossil fuels?

Oil challenges liveness from another ontological perspective, as a substance that was, once, live matter and that acts with a force suggestive of a form of life. Just as anthropologists like Stefan Helmreich are looking to the microbial oceans “to explore shifting limits of the category of life,” the microbial life in oil, in addition to oil’s deep geologic history as life-through-time, forces questions of how biology, geology, and culture come together to define what counts as living matter. When the concept of nature animates petroleum aesthetics, in oil museums where, for example, fossils are prominently displayed, the category confusion of life or oil powerfully disarranges the historic role of petroleum in the materials economy. It might seem that my task would be one of unconcealment in such cases. But often I find the confusion of oil and life more interesting than their segregation. To invoke Richard White once again, I think that the centuries of work we’ve done as modern humans to immerse ourselves in oil means that, in fact, we are loathe to disentangle ourselves or our definition of life from it. This does not mean, of course, that Tough Oil World is inevitable.

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from "Living Oil: Petroleum Culture in the American Century (Oxford Studies in American Literary History Book 5)" by Stephanie LeMenager

"When in 2008 Dr. Rajendra Pachauri, chair of the United Nations Intergovernmental Panel on Climate Change, asked the world’s population to reduce its meat consumption, his bold imperative surprised and offended some people. Certainly the average American, eating ninety-six cheeseburgers per year, might understand Dr. Pachauri’s directive as evidence of a vegetarian bias—rather than an indication that meat production in fact counts for one fifth of global greenhouse gas emissions, with the methane emitted by ruminants such as cows being 23 times more effective than carbon dioxide as an agent of global warming. So Ms. Hoysal’s Appendix both implicates my method of cultural production in the problem that launched my writing in the first place, making for a necessary confession, and **it places the energy footprint of cultural objects such as books and films into perspective.** Agriculture demands more gas and diesel than other sectors of the world economy. So before we stop reading, viewing, writing, and printing books—the latter a possibility worth considering, and made realizable by e-text—we’re going to have to stop eating. Or, at least, we in the United States will have to stop eating the way that we do, as omnivores within an

industrial food system that sends items to our plates by an average distance of 1,500 miles. Enjoy this book, and if you don't enjoy it, resell it."

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USING STORY TO CHANGE SYSTEMS article by Elle Saltmarshe

https://ssir.org/articles/entry/using_story_to_change_systems

The work of systems change involves seeing systemically—looking at the elements, interconnections, and wider purposes of systems—and acting systemically. Story plays a vital role in helping us do both of these things.

Story has many different qualities that make it useful for the work of systems change. It's a direct route to our emotions, and therefore important to decision-making. It creates meaning out of patterns. It coheres communities. It engenders empathy across difference. It enables the possible to feel probable in ways our rational minds can't comprehend. When it comes to changing the values, mindsets, rules, and goals of a system, story is foundational.

This article is a field guide to three qualities of story and narrative that all sectors can use to change systems: story as **light, as glue, and as web.**

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ECOCRITICISM ON THE EDGE. by Timothy Clark

CHAPTER NINE The tragedy that climate change is not 'interesting'

Ecocritics have been responding to a call for humanity newly to realize itself in its role as a truly global species. It would entail a new cosmopolitanism, transcending given cultural, natural, economic and social boundaries, the accomplishment of a sort of communal super-subjectivity—a peaceful, future epoch with humanity as the mindful steward of life on Earth. What else could there be to hope and work for? At the same time, these hopes should not ignore a crucial feature of the Anthropocene. This is its growing spectacle of the human as a species in the way other animals are species, that is as the creatures of a specific and a largely but not fully determining biology that plays itself out in individual lives over and above the way specific selves may perceive themselves and their goals.

The call to kinds of global cosmopolitanism...

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The result has been a great deal of innovative work, but the challenges and difficulties faced by such art have also been striking, given that crucial forms of environmental destruction cannot immediately be seen or localized, and resist representation at the kinds of scale at which most poetry, narrative or drama operate. The question that dominates this chapter, and which can be elucidated but not resolved, is this: are the limits of imaginative engagement emerging in these novels, poems, piece of music and in painting, sculpture, cinema, art installations and so on, merely the limits of now

anachronistic cultural conventions, capable of reinvention? Or, more profoundly, does the Anthropocene form a threshold at which art and literature touch limits to the human psyche and imagination themselves?

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HERE ON EARTH A Natural History of the Planet TIM FLANNERY

Foreword

This book is a twin biography of our species and our planet. At its heart lies an investigation of sustainability—not how we achieve it, but what it is. I have written it at a time when hope that humanity might act to save itself from a climatic catastrophe seems to be draining away. Yet I am not without hope, for I believe that as we come to know ourselves and our planet we will be moved to act. Indeed, provoking that action is the purpose of this book.

What is the nature of Earth? Is it akin to a cell, an organism or an ecosystem? How much energy does it require to operate? What is that energy used for, and how is it deployed? How flexible are Earth's systems? Can they withstand severe challenges, and can their resilience and productivity be enhanced? And what of us? Are we constituted by natural selection to be so selfish and greedy that we're doomed to catastrophe? Or are there reasons to believe that we can overcome the problems confronting us, allowing our civilisation to continue? What of civilisation itself? What, precisely, is it?

These are some of the questions I attempt to answer in this book. Guiding me are the two great strands of evolutionary theory—reductionist science as epitomised by Charles Darwin and Richard Dawkins, and the great holistic analyses of the likes of Alfred Russel Wallace and James Lovelock. Each pursues a truth that at first seems to be in opposition to the other, but in the enormous complexity that is our living planet they operate as necessary and complementary opposites. When viewed together, these Darwinian and Wallacean world views, as I call them, provide a convincing explanation of life as a whole—and of what sustainability entails.

Fifty thousand years after our ancestors left Africa, our species is entering a new phase. We have formed a global civilisation of unprecedented might, a civilisation that is transforming our Earth. We have become masters of technology, spinning energy from matter at will and withal realising the dreams of the alchemists—transforming one element into another. We have trod the face of the Moon, touched the nethermost pit of the sea, and can link minds instantaneously across vast distances. But for all that, it's not so much our technology, but what we believe, that will determine our fate.

Today, many think that our civilisation is doomed to collapse. As I will show, such fatalism is misplaced. It derives in large part from a misreading of Darwin, and a misunderstanding of our evolved selves. Either such ideas will survive, or we will.

There are others who believe that endless growth is possible. In their imaginations only the fittest survive, and human intelligence will triumph over all. This optimism also derives from a misreading of Darwin, but it owes much as well to ignorance of the fundamentally important insights of Wallace and Lovelock. Despite their patently flawed nature, such foolishly optimistic ideas have now reigned largely unchallenged in western society for 150 years and have already led us far down the road to a dismal fate. Unless corrected, they may become a fatal flaw indeed.

Narrow horizons and short time frames are always misleading. That's why it's impossible to determine whether, even in the dramatic changes we see over a lifetime, we're witnesses to a descent into chaos, or a profound revolution that will lead to a better future. **A wider view, one that encompasses humanity over the millennia and the world over the aeons, is required if we are to discern the true path of our evolutionary trajectory. In writing this book I've taken that long view, and, despite the challenges we now face, I feel optimistic—for ourselves, our children and our planet.**

If we are to prosper, we must have hope, goodwill and understanding.

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ECOCRITICISM ON THE EDGE. by Timothy Clark

Chapter Eight

Denial: A reading It was as far as their imaginations would allow, and it was too far. 1

More and more people in the so-called developed world do have an environmental understanding of the situation in which they find themselves. They are aware that, for example, 'just' driving to work, heating a house or 'just' flying for brief trip abroad is not the whole situation, and that the larger-scale picture implies a re-evaluation of the significance of what they are doing. In this way, to keep on doing the same old thing – as if it were still 'just driving to work' and so on – shifts subtly towards the status of being a form of denial. The word sounds like an accusation, but in these cases 'denial' is less the assumed property of a personality than of the encompassing condition in which it finds itself. ***Most modern infrastructure in the developed world is, so to speak, denial in concrete, for the distribution of buildings, work places, shopping areas and roads encourages or even enforces certain ways of life, such as private vehicle use, and makes (only temporary) sense in a period of cheap fossil fuel use. For millions of people, the objects and routines of normal, daily life are forms of denial in this extended, only distantly psychological sense, a subtle mix of knowledge, inertia, self-deception, evasion and material entrapment.***

Environmental criticism in the Anthropocene is likely to be more and more about unacknowledged denial. An environmental critic who still thinks it normal or even

prestigious to take an international flight to attend an academic conference would be one trivial example of this.

An alarming and pervasive ‘denialism’, what many call ‘normal life’, becomes itself an enigma for environmental thinking. Yet environmental writers are often still held back by certain strategic assumptions in their work. First, as John Keen writes, ‘In spite of Darwin’s contribution linking mankind with its biological heritage and Freud’s account of the disowned operations of the mind, our public discourse tends to follow the Enlightenment view that rational thought now predominates.’² [2John Keene, ‘Unconscious Obstacles to Caring for the Planet’, in Sally Weintrobe (ed.), *Engaging with Climate Change: Psychoanalytic and Interdisciplinary Perspectives* (London: Routledge, 2013), 144–59, 144.] *Thus now innumerable popular science books on the crisis, how ‘we’ got here and the cultural transformations ‘we’ must urgently undergo to avert further disaster are all implicitly investing in the Enlightenment faith that a deficit of understanding is at the root of the issue, and that once people know and understand the insidious dangers of the Anthropocene, the appropriate individual, social and political measures will follow. **Yet this is to assume a naïve model of the human mind and behaviour increasingly being refuted by reality,***

“a model premised on a unitary and rational self, not one that is torn, ambivalent and in two minds (or several minds, for that matter); nor one whose sense of self, other, environment and so on is governed by powerful narratives, meanings and imaginings, nor one besieged by potentially overwhelming emotions such as fear, despair, anxiety, guilt, love or hope.”³ [3Paul Hoggett, ‘Climate Change in a Perverse Culture’, in *Engaging with Climate Change*, 56–70, 56.]

The widespread and increasingly disastrous ‘apathy’ about climate change ascribed to many people in the developed world, always more interested in debating the location of some ‘much-needed’ new airport or ‘relief road’ **than doing anything to help consider the mass extinction of life, is often not apathy, in a sense of not caring, or denial in the simple, psychic sense, but withdrawal of affect as a sort of defence. To withdraw attachment to a threatened object is a way of protecting oneself.**⁴ [4Renee Aron Lertzman, ‘The Myth of Apathy’, in *Engaging with Climate Change*, 117–33.]

In respect..

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the kind of denial at issue is not a repudiation of fact, as with some politicized climate change deniers, but ‘integrative denial’, meaning that there is a failure or inability to ‘integrate this knowledge into everyday life or to transform it into social action’ (Norgaard, 11).

So for Norgaard, climate change denial in ‘Bygdaby’ is not primarily to be traced to the propaganda of the rich and powerful intent on defending selfish short-term interests.

¹⁵ She registers how society actively if unconsciously produces various modes and

strategies for managing and maintaining denial, even in Norway, a country where knowledge of global warming is prevalent. Denial inheres, rather, in the fact that so many dominant ways of making sense or ascribing importance to things in ordinary life and social interactions implicitly negate, or at least would like to negate, the thought of global environmental disaster. Norgaard writes: 'In sharp contrast to psychological approaches to denial, the notion of socially organized denial emphasizes that ignoring occurs in response to social circumstances and is carried out through a process of social interaction' (9; Norgaard's emphasis), through conversation and its norms. Climate change denial may be implicit in things as innocuous as the trivial but entrenched conventions of daily conversation, the shared respect for certain expectations of sociability and composure. Lacking an adequate integrative context, anxieties about the future are only expressed in occasional individual confidences or passing jokes about the weather, rarely in socially sanctioned contexts that lead to any form of more active engagement or political activity. Norgaard makes instead the surprising claim:

'I wish to clarify that a key point in labelling the phenomenon of no direct activity in response to climate change as denial is to highlight the fact that nonresponse is not a question of greed, inhumanity, or lack of intelligence. Indeed, if we see information on climate change as being too disturbing to be fully absorbed or integrated into daily life . . . this interpretation is the very opposite of the view that nonresponse stems from inhumanity or greed. **Instead, denial can –and I believe should –be understood as testament to our human capacity for empathy, compassion, and an underlying sense of moral imperative to respond, even as we fail to do so.**' (61; Norgaard's emphasis)

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Elizabeth Grossman. Chasing Molecules: Poisonous Products, Human Health, and the Promise of Green Chemistry (Kindle Locations 2342-2348). Kindle Edition.

Scientists are now watching natural systems and cellular feedback loops that have evolved over millennia begin to falter in response to chemical wrenches we've introduced into the global environment. The materials we've used for the past century have served us well in many ways. But we can no longer afford-if we ever could-to proceed with designs that serve but one generation.

Making the changes in energy sources and materials that would result even in a "less bad future" for the world's climate and biochemical health, let alone create a new, environmentally benign materials stream, would present enormous challenges in the best of times. In many ways that task has just become more difficult with the precipitous drop in world financial markets in the fall of 2008 and early 2009. Yet it is possible that the juncture at which we find ourselves-environmentally and economically-may provide the impetus we need to reassess and proceed in a new direction.

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Gardiner, Stephen M.. A Perfect Moral Storm (ENVIRONMENTAL ETHICS AND SCIENCE POLICY SERIES) (pp. x-xiv). Oxford University Press. Kindle Edition.

Preface

Those of us working on global ethics and political philosophy tend to think about grand theories of justice and rights, trying to figure out which are the best, how they apply to the world that we live in, and how they might guide us in making it better. However, this is not that kind of book. Instead, my aim is to characterize our predicament—humanity’s and especially that of richer nations and peoples. This seems to me where the action is right now. We need to understand what the problem is that we are trying to solve, and why it is so persistent. Until we do, attempts at solutions are likely to be shallow. In the hope of piquing your interest, let me gesture at the main claims of the book by announcing eight propositions.

PROPOSITION 1: RUNAWAY EMISSIONS We are currently accelerating hard into the most serious global environmental problem that humanity has ever faced. If the scientists are to be believed, the planet is at serious risk of a shift in global climate comparable in magnitude to an ice age (albeit in the other direction), but occurring over decades rather than millennia. Yet, despite more than twenty years of awareness, we are neither slowing down nor stabilizing, let alone actually reducing, our collective input to the problem. Instead, we continue to add more fuel to the fire, faster and faster, producing an almost exponential rise in anthropogenic emissions of carbon. This, arguably, is the most striking fact of our time.

PROPOSITION 2: A DUBIOUS FRAMING In public discussion, we do not understand the striking fact in the most relevant terms, and so conceive of the problem in the wrong way. The dominant discourses about the nature of the climate threat are scientific and economic. But the deepest challenge is ethical. What matters most is what we do to protect those vulnerable to our actions and unable to hold us accountable, especially the global poor, future generations, and nonhuman nature.

PROPOSITION 3: A PROFOUND CHALLENGE Our problem is profoundly global, intergenerational, and theoretical. When these factors come together they pose a “perfect moral storm” for ethical action. This casts doubt on the adequacy of our existing institutions, and our moral and political theories.

PROPOSITION 4: A PROBLEMATIC PARADIGM In the environmental discourse, the presence of the perfect moral storm is obscured by the dominance and pervasiveness of an alternative, narrower analysis. According to this account, climate change is a paradigmatically global problem best understood as a prisoner’s dilemma or tragedy of the commons played out between nation states who adequately represent the interests of their citizens in perpetuity. However, such models assume away many of the main issues, and especially the intergenerational aspect of the climate problem. Hence, they are inadequate in this case, and perhaps many others. This point has theoretical as well as practical implications.

PROPOSITION 5: A THREATENED DISCOURSE In the perfect moral storm, our position is not that of idealized neutral observers, but rather judges in our own case, with no one to properly hold us accountable. This makes it all too easy to slip into weak and self-serving ways of thinking, supported by a convenient apathy or ideological fervor. Moreover, the devices of such corruption are sophisticated, and often function indirectly, by infiltrating the terms of ethical and epistemic argument.

PROPOSITION 6: SHADOW SOLUTIONS Given this, we are susceptible to proposals for action that do not respond to the real problem. This provides a good explanation of what has gone wrong in the last two decades of climate policy, from Rio to Kyoto to Copenhagen. However, the form of such “shadow solutions” is likely to evolve as the situation deteriorates. Some recent arguments for pursuing geoengineering may represent such an evolution.

PROPOSITION 7: A DEFENSIVE STRATEGY The perfect storm constitutes a nonneutral evaluative setting, and this poses special challenges for ethical action. Because we are judges in our own case, there is a role for “defensive” moral and political philosophy, especially in the public sphere. In particular, we should work as hard at identifying bad arguments, policies, and theories as on developing the good; and we must pay attention to the ways important values are articulated, since the likelihood of their perversion is high.

PROPOSITION 8: EARLY GUIDANCE

Although the theoretical component of the perfect moral storm is serious, it does not follow that nothing useful can be said about confronting the ethical challenge. Instead, there are serious constraints on moral and political reasoning involving many of the main aspects of the climate problem, such as scientific uncertainty, intergenerational ethics, and intragenerational justice. Paying attention to these suggests that the current public debate about climate should be reoriented. These eight propositions seem to me difficult to dispute. If they are correct, the issues before us are serious and deep-rooted. I hope that we will rise to the occasion.

Stephen Gardiner
Seattle June 2010

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Funk, Mckenzie. Windfall (p. v). Penguin Publishing Group. Kindle Edition.

In the run-up to successive climate conferences in Copenhagen, Cancún, Durban, and Doha, as everyone else was fretting about polar bears and electric cars, some fund managers worried I would misunderstand them—that I would mistake them for starry-eyed activists, that I would mistake theirs for just another green or socially responsible fund. “A lot of people think, ‘How do you invest in climate change?’ and essentially come up with one or two or maybe three areas, like alternative energy,” Sophie Horsfall, a manager of Britain’s F&C Global Climate Opportunities Fund, told me. “For

us, well, there is an awful lot more to it. We have to separate out the ethical values. We have to move away from the environmental issues. We have to take a step back.” I must have looked puzzled. “We have to think about the reality of climate change,” she continued. “It is quite difficult, isn’t it?”

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This book is about how we’re preparing for the world we seem hell-bent on creating. It’s about climate change, but not about the science of it, nor the politics, nor directly about how we can or why we should stop it. Instead, it’s about bets being placed on a simple, cynical premise: that we won’t stop it anytime soon. It’s about people, and mostly it’s about people like me: northerners from the developed world—historically the emitter countries, as we’re called—who occupy the high, dry ground, whether real or metaphorical.

I’m interested in climate change as a driver of human behavior—as a case study, the ultimate case study, in how we confront crisis. Warming will reshape the planet, and in broad strokes we already know how: Hot places will get hotter. Wet places will get wetter. Ice will simply melt. Poor, mostly tropical countries, those least responsible for the consumption that fuels the factories that produce the emissions that cause the warming, will be hit hardest, but wealthier, higher-latitude regions—Europe, Canada, the United States—are not entirely immune. The change is so vast, so universal, that it seems to test the limits of human reason. So it should not be surprising that the ideologies that led us here, those that have guided the postindustrial age—techno-lust and hyper-individualism, conflation of growth with progress, unflagging faith in unfettered markets—are the same ones many now rely on as we try to find a way out. Nowhere is humankind’s mix of vision and tunnel vision more apparent than in how we’re planning for a warmed world.

Funk, Mckenzie. Windfall (p. v). Penguin Publishing Group. Kindle Edition.

End of last chapter

THE SUMMER OF 2012 was hot in Seattle, too. Jenny and the new baby and I often slept downstairs, because upstairs was too warm and we’d never had much need for air-conditioning before. We went swimming more than usual; it was nice. We bought a bigger car—a relative gas-guzzler, but it fits the whole family. Our house is near Seattle’s new light-rail, and during a remodel I made sure we insulated it well and got a high-efficiency furnace. But we drove all over that summer, and we bought a lot of Shell gas. The many flights I took, from a carbon perspective, were even worse.

One afternoon, after I watched the Kulluk get towed north, I went to the “prediction market” Web site Intrade and put a \$100 wager down in its Climate and Weather category. I could have bet on global temperature anomalies or on Sandy being the last named storm of the 2012 hurricane season, but instead I chose the melting polar ice cap: “Arctic sea ice extent for Sep 2012 to be less than 3.7 million square kilometres.”

It was all in good fun, just a stunt to prove that any one of us, especially those in a comfortable place, could idly bet on climate chaos. But I won handily.

There is something crass about profiting off disaster, certainly, but there is nothing fundamentally wrong with it. I did not write this book to take aim at honest businessmen like Mark Fulton, Phil Heilberg, and Luke Alphey or at good soldiers like Sergeant Strong and Minik Kleist. If they are vilified because readers have not fully grappled with the landscape in which they live, the landscape in which we all live, then I have failed to describe it well enough.

The hardest truth about climate change is that it is not equally bad for everyone. Some people—the rich, the northern—will find ways to thrive while others cannot, and many people will wall themselves off from the worst effects of warming while others remain on the wrong side. The problem with our profiting off this disaster is not that it is morally bankrupt to do so but that climate change, unlike some other disasters, is man-made. The people most responsible for historic greenhouse emissions are also the most likely to succeed in this new reality and the least likely to feel a mortal threat from continued warming. The imbalance between rich and north and poor and south—inherited from history and geography, accelerated by warming—is becoming even more entrenched.

Environmental campaigners shy away from the fact that some people will see upsides to climate change—more minerals for miners, more famines for food sellers—because any local gains muddy the otherwise catastrophic picture of a world without emissions cuts. I have not shied away, for the people described in these pages reveal something important: In an unfair world, rational self-interest is not always what we wish it would be. In economic terms, global warming is not merely an externality that we have failed to price in. The free market can only get us so far. This makes it a truly wicked problem, but it also gives us a more perfect moral clarity. We are not simply borrowing against our own future. For the most part, we are not our own victims. To rely on empathy to shape our response to climate change is often considered naive—the victims of warming are distant in space, distant in time, and the bullets are invisible—but I believe it is more naive to hope that we in the north will significantly cut emissions or consumption or give needed adaptation funding to distant countries because we personally feel threatened.

In the world ahead, the politics of anger are not likely to work without the corresponding empathy. It is not enough to get mad at the oil companies—though it might help a little bit. There have been various postmortems about why the U.S. Senate has not passed a climate bill, or why the UN cannot get a treaty, but the reason is fairly straightforward: In the wealthy north, where we still talk more about polar bears than about people, there is no true constituency. Hardly anyone cares that much. Not yet.

When I was halfway through this project, I was checking facts with a source, an investment banker in New York who had acquired some foreign farmland. We got into an argument. What had happened along the way to his getting his tracts—a series of

swindles by middlemen, of small farmers bought out by forces much larger than they could imagine—was not his fault, he said. It happened before the bank was involved. “It’s like I bought some weed from a guy who bought it from another guy who bought it from another guy who bought it from a guy in Guatemala who killed someone for it,” he said. But you knew, I argued back. Before he bought it, he knew where it had come from. He knew what his boon had cost someone else.

Climate change is often framed as a scientific or economic or environmental issue, not often enough as an issue of human justice. This, too, needs to change. From this moment on, many of us could get rich. Many of us could get high. Life will go on. Before it does, we should all make sure we understand the reality of what we’re buying.

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Add a section here from Vaclav Smil [sp?] last chapter on 3 orders of magnitude efforts needed. Learn to think in 3 - 4 orders of magnitude.

Adding three zeros. 000 to numbers, one exponential count of $10 + 1$ steps of doublings....

Learn these numbers: “1, 2, 4, 8, 16 [5 steps], 32, 64, 128, 256, 512 [5 more steps, 10 total and 1 more is...] 1,000. How to move atoms at same rate of doubling as bits?

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COPIED FROM:

EYE ON THE MARKET JP MORGAN March 2019 paper
MOUNTAINS AND MOLEHILLS

Why all the focus on de-carbonization?

I asked Vaclav to articulate for our clients why de-carbonization is so important. His response is useful for those who are convinced by consensus views on climate science, and for those still on the fence:

“Underlying all of the recent moves toward renewable energy is the conviction that such a transition should be accelerated in order to avoid some of the worst consequences of rapid anthropogenic global warming. Combustion of fossil fuels is the single largest contributor to man-made emissions of CO₂ which, in turn, is the most important greenhouse gas released by human activities. While our computer models are not good enough to offer reliable predictions of many possible environmental, health, economic and political effects of global warming by 2050 (and even less so by 2100), we know that energy transitions are inherently protracted affairs and hence, acting as risk minimizers, we should proceed with the de- carbonization of our overwhelmingly carbon-based electricity supply – but we must also appraise the real costs of this shift. This report is a small contribution toward that goal.”

Acknowledgements: our technical advisor Vaclav Smil

As always, our energy Eye on the Market was overseen by Vaclav Smil, Distinguished Professor Emeritus in the Faculty of Environment at the University of Manitoba and a Fellow of the Royal Society of Canada. His inter-disciplinary research includes studies

of energy systems (resources, conversions, and impacts), environmental change (particularly global biogeochemical cycles), and the history of technical advances and interactions among energy, environment, food, economy, and population. He is the author of more than 40 books (the latest one, *Growth*, will be published by the MIT Press in September) and more than 400 papers on these subjects and has lectured widely in North America, Europe, and Asia. In 2010, *Foreign Policy* magazine listed him among the 100 most influential global thinkers. In 2015, he received the OPEC award for research, and is described by Bill Gates as his favorite author.

Acronyms used in this paper

AC alternating current;
BTU British thermal unit;
BTX benzene/toluene/xylene;
CCS carbon capture and storage;
CO₂ carbon dioxide;
DC direct current;
EIA Energy Information Agency;
EPA Environmental Protection Agency;
ERCOT Electric Reliability Council of Texas;
EV electric vehicle;
GHG greenhouse gas emissions;
GW gigawatt;
GWh gigawatt-hour;
IEA International Energy Agency;
IPCC Intergovernmental Panel on Climate Change;
IRENA International Renewable Energy Agency;
ISO independent system operator;
kg kilogram; km kilometer;
kW kilowatt; kWh kilowatt-hour;
L liter; MJ megajoule;
MMT million metric tons;
Mt metric tonnes;
Mtoe million tons of oil equivalent;
MW megawatt; MWh megawatt-hour;
NREL National Renewable Energy Lab;
TWh terawatt hour;
VAT value added tax;
Wh watt-hour

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From BLESSED UNREST by Paul Hawkin

“For similar reasons we may deduce that it is reasonable to conclude that we cannot embrace or manage the plethora of problems that confront us. The world simply appears to be out of control. Too often, however, such problems seem insoluble because of how they are managed—with ideological, top-down, oligarchic, militaristic

management styles. If we tried to consciously control our bodies, we would die, just as the planet is dying. We don't manage our bodies because we cannot. We can, however, protect, nurture, listen to, and tend to them with food, sleep, prayer, friendship, laughter, and exercise. And that is all the planet asks from us: allies, rest, nurturance, respect, celebration, collaboration, and engagement. Can a global system of citizen-based organizations with simple, clear values turn the world away from war, climatic chaos, social devolution, and environmental collapse? If history is a guide, the answer is no. In the past two centuries, we have seen the struggles for fundamental rights of freedom, democracy, and human dignity repeatedly overtaken by chronic and endemic poverty. On top of that ongoing effort, we now face another task, a campaign to surmount our legacy of environmental neglect. To succeed requires ubiquity, a network of informants, a conspiracy of social imaginaries, groups that cultivate new knowledge, share it, seek information elsewhere, and provide it to agencies and citizens who need it. Without question, each individual part of the movement is not up to the task, for it will inevitably be outgunned by larger institutional forces. But as each organization attends to its mission, it need not attempt to match the sheer firepower arrayed against it. These groups do not have to dominate the world with a new order; they need only take their rightful place in a multicentric planet in which no institution is dominant. Rather than having megasolutions, they need to solve for pattern. 17

The term solving for pattern was coined by Wendell Berry, and refers to a solution that addresses multiple problems instead of one. Solving for pattern arises naturally when one perceives problems as symptoms of systemic failure, rather than as random errors requiring antidotes. For example, sustainable agriculture addresses a number of issues simultaneously: It reduces agricultural runoff, which is the main cause of eutrophication and dead zones in lakes, estuaries, and oceans; it reduces use of energy-intensive nitrogen-based fertilizers; it ameliorates climate change, because organic soil sequesters carbon, whereas industrial farming releases carbon dioxide to the atmosphere, and is the second-greatest cause of climate change after fossil fuel combustion; it improves worker health because of the absence of toxic pesticides; it enables soil to retain more moisture and is thus less reliant on irrigation and outside sources of water; it is more productive than conventional agriculture; it is less susceptible to erosion; and it provides habitat for pollinators, birds, and beneficial insects, which promotes biodiversity. On top of all that, the resulting food commands a premium in the market, making small farms economically more viable. Solving for pattern is the de facto approach of the movement because it is resource constrained. It cannot afford "fixes," only solutions.

Nature works in cycles, and so does a healthy society. A self-correcting system thrives because of feedback. The movement is composed of small organizations because it is on the ground, with its people at the scene—a scale at which information can be generated and acted upon. At this level, organizations quickly adapt. Mistakes are hidden treasures, Joycean "portals of discovery," because we learn from our failures. The opposite of learning is a runaway system where mistakes are relegated to file cabinets and ignored. When a government, corporation, financial institution, or religious organization insulates itself, its initiatives, however well intended, create

uncontrolled outcomes and second-order effects that generate newer problems. The current state of the world reflects a problem-solving methodology never seen in nature: remedies from above imposed upon the excluded. The movement offers a solution-creating methodology from below that is inclusive, a process that mimics biological adaptation and evolution. Every physical activity the human body sustains is part of a cyclical, biological system with a self-correcting bias. The same should be true of every social activity, with a system called democracy.

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From: Survivors The Animals and Plants That Time Has Left Behind by Richard Fortey

EPILOGUE

It is always good to get back from a long field trip abroad, but I know at once that something is wrong. There is an unpleasant sweetish smell in the air. At first I think that a bird must have died in the house and gone through its cycle of decay, leaving behind a whiff, a memory of decomposition. There is something indefinably nauseating about the pong, something intrusive. I throw open the window and go into the kitchen. As light floods the room a dense scuttling sound, a scraping, urgent, oddly dry noise alerts me to the truth. Ugh, cockroaches! Even now they are fleeing into the dark crevices between my cupboards and under my sink, and off into a mouse hole in the skirting board (I really must fix it one of these days). These insects shun light. I had no idea that they were infesting my premises. They must have proliferated in my absence. I accept insect visitors like tiny, flightless silverfish (*Thysanura*) with long bristly tails as these are harmless little creatures; and anyway they serve as a living memento of a time before insects had wings. They are another old timer. But there is something singularly succulent and juicy about a cockroach that induces shudders, even in a professional arthropod man. Their antennae seem too long, their jointed legs unnecessarily spiky. They are not a good colour. When I attempt to hit it with a shoe, one fat specimen cornered on the floor hisses at me, but that does not save it. Then I open the cupboard door and discover a horrible jar of something heaving with cockroach nymphs of several sizes, wingless and twitching miniature versions of their parents: no maggot or caterpillar stage for these guzzlers. Peering into the cracks behind the sink I see dozens of pairs of antennae, smelling the air. When I wake up the following morning, I realise a mouse has eaten the dead cockroach. That's ecology for you.

Cockroaches are not related closely to beetles, although they might look a little like them. My distaste for them is rooted in something irrational. After all, they do what they do very well, and they are remarkable old timers. Their relatives go back to the Carboniferous Period, so they have had 300 million years to perfect the art of living on almost anything organic. They have also come through two mighty extinction events, the one at the end of the Permian being the king of them all. 'Alpha for persistence', as one of my schoolmasters was fond of saying. Cockroaches crawled on the damp forest floors while trees that would finally make coal grew all around. To most observers the early roaches look much like the ones still living, but to those with a passion for Blattaria—and every animal group has its devotees—they had a way to go before they

could move into my jam pot. They appeared 200 million years before the first moths and butterflies. Only the dragonflies match them in antiquity among winged insects.* Maybe out of respect I should not have squished that large specimen with my shoe. I should have helped it on its way.

Cockroaches are distributed worldwide away from cold latitudes, so there is nothing relict about them; they must have continued to scuttle over Pangaea when life was almost snuffed out 250 million years ago, and subsequently they were carried away to all parts of the world when the great continent broke up. They are numerous in Australia, where I saw really big ones clambering over eucalyptus trunks in the setting sun. I have watched with awe as they scaled bedroom walls in Malaysia. In their six-legged way, they do conform to some of the other survivors. They are long lived and can exist for several years in a tank. Many other insects have grubs that last for a long time buried in wood, or living in ponds, but the adult usually only lives briefly after metamorphosis, when it is time to breed. Then, like the crocodile, cockroaches can go for a long time without food; this means something like a month, which is a long time for a small creature. Some species lay relatively few eggs and one species even gives birth to live young, but others are as prolific as any bug on the block. They can endure high doses of radiation. Nobody seems to like them much, but they must earn a grudging respect for their durability and lack of fussiness. So the cockroaches will guzzle on until the last scrap of food is consumed when, it might be supposed, they will turn on one another. For some reason I am reminded of another animal that is too numerous, that seems to guzzle everything immoderately, and may finish up turning on his fellows. D. H. Lawrence nailed him thus (although inspired by rabbits rather than roaches):

There are too many people on earth insipid, unsalted, rabbit, endlessly hopping. They nibble the face of the earth to a desert.

It has been a privilege to get to know every animal and plant in this book. They were chosen from the millions of species on our planet because they had something to say about evolution. Old timers help to explain distant origins in strange worlds. I have no doubt at all that had I made a different selection of organisms to include in this book their biographies would have been every bit as interesting. Humans are only one species in the great inventory of the biosphere, but anthropocentrism rules just about everywhere. I have even met fanatics who maintain that wildlife was created as a source of food and entertainment for just one bipedal hominin, who deserves to have total dominion. I do not like to mix science with moral strictures, but it would not be possible to have made the journeys I have made without caring desperately that something as ancient as the lungfish should see another decade. After hundreds of millions of years that is nothing less than justice. I grieve that the Nautilus that has survived the dinosaurs is declining because of a trade in tourist trinkets. Our 'endlessly hopping' species is squeezing everything. The extinction event that is happening right now is the first one in history that is the responsibility of a single species. There's no meteorite this time, no exceptional volcanic eruptions, no 'Snowball Earth', just us, prospering at the expense of other species. We have not nibbled the face of the earth

to a desert yet, but if our human numbers go on growing it looks like a plausible end. Some time soon, it has got to stop. We can do something about it. After all, we are not cockroaches.

I am not worried about the survival of bacteria. They will be there to rot down the last bodies of the last humans, and then the wheel of life will have turned full circle.

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Paul Hawkin Univ of Oregon commencement talk 2009 excerpt
<https://www.commondreams.org/views/2009/05/23/paul-hawkins-commencement-address-class-2009>

“The first living cell came into being nearly 40 million centuries ago, and its direct descendants are in all of our bloodstreams. Literally you are breathing molecules this very second that were inhaled by Moses, Mother Teresa, and Bono. We are vastly interconnected. Our fates are inseparable. We are here because the dream of every cell is to become two cells. And dreams come true. In each of you are one quadrillion cells, 90 percent of which are not human cells. Your body is a community, and without those other microorganisms you would perish in hours. Each human cell has 400 billion molecules conducting millions of processes between trillions of atoms. The total cellular activity in one human body is staggering: one septillion actions at any one moment, a one with twenty-four zeros after it. In a millisecond, our body has undergone ten times more processes than there are stars in the universe, which is exactly what Charles Darwin foretold when he said science would discover that each living creature was a "little universe, formed of a host of self-propagating organisms, inconceivably minute and as numerous as the stars of heaven.”

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From WALKING ON LAVA Selected Works for Uncivilised Times
Dark Mountain Essays complication book

Have we succeeded? That's for others to say. What we can say is that the years which separate the writing of our manifesto from the publishing of this book have seen a widening awareness of the instability of our civilisation and the seriousness of the threats which face it. The kind of arguments which saw us attacked as 'doomers' when we published them in 2010 can be found today on the comment pages of international newspapers. It is becoming harder and harder to deny that what we used to think of as 'progress' is faltering badly. What happens next is the interesting part.

What can writing do about this? What problems can art solve? In one sense, the answers are: nothing, and none. But in another sense, these are the wrong questions. **'All civilisations', we wrote in the manifesto, 'are built on stories.' When the stories fail, we need to know how to tell different ones. We need to have the perspective to understand the failure, and the imagination to offer up new ways of**

seeing. This is what Dark Mountain set out to do: to play host to voices seeking honest engagement with questions which might be intractable. How else does art get made?

Walking on Lava contains words and images selected from the ten books that the Dark Mountain Project has so far published.

Chapter REMEMBER THE FUTURE by Douglas Hine

To understand this, it may help to start with words, to pull words to pieces in order to put them back together. 'To provide' is to have foresight. The word 'improvisation' is very close to the word 'improvident', and to be improvident is not to have looked ahead and made provision. **'To improvise' turns that around, into something positive, because improvisation is the skill of acting without knowing what is coming next, of being comfortable with the unknown, with uncertainty, with unpredictability.**

I have come to see **improvisation as the deep skill and attitude which we need for the times that we're already in and heading further into.** Part of the truth of how climate change, for example, will play out at the level where we actually live our lives is through increased unpredictability. Less able to rely on processes and systems which we have taken for granted, we are confronted by our lack of control. This will throw us acute practical challenges, but also—as in the coalfield communities of Rachel Horne's life and work—the challenge of holding our sense of meaning together in times of drastic change.

When you consider the history of improvisation, you encounter something like a paradox. Because it is arguably the basic human skill, the thing that we are good at. It is what we have been doing for tens of thousands of years, over meals and around campfires, in the marketplace, the teahouse or the pub. Every conversation you have is an improvisation: words are coming out of your mouth which you didn't plan or script or anticipate. And yet we are accustomed to think of improvisation as a specialist skill, a kind of social tightrope-walking; this magic of being able to perform, to draw meaning from thin air, to make people laugh or make them think without having had it all written out beforehand.

Our fear of improvisation is, at least in part, a result of what industrial societies have been like and what they have done to us. I want to offer the distinction between 'improvisation' and 'orchestration' as two different principles by which people come together and do things. In these terms, we could talk about the industrial era as having been peculiarly dominated by orchestration.

Orchestration is the mode of organisation in which great amounts of effort are synchronised, coordinated and harnessed to the control of a single will.

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From WIRED FOR HEALING book, by Annie Hopper

Overactivation of threat centres in the limbic system are related to survival emotions including fear, rage, anger, worry, depression, hopelessness, and catastrophic thinking. According to Singer and Johnson (2006), "More than 850 industrial and commercial chemicals are known to cause neurobehavioral disorders." These symptoms can be present to varying degrees in all limbic system related conditions and are not limited to chemical sensitivities.

Physiological reactions to exposure or perceived threat can include severe mood swings, sudden and severe depression, rage, crying, and suicidal ideation (preoccupation with thoughts of suicide). Patients are often emotionally overreactive to stress, which can exaggerate physical symptoms. Some cannot cry with appropriate stimulus, e.g. even with the death of a loved one. In contrast, others are unable to genuinely laugh. Patients also have a general difficulty accessing positive emotional states or positive memories. They often have an exaggerated startle response and extreme harm avoidance behaviours. In addition to the emotional symptoms, patients may also experience psychological symptoms such as hyper vigilance, a heightened sense of threat, negative self-absorption, and a tendency toward blame and defensiveness.

When fear centres in the brain become chronically activated, it can feel as though your brain has been hijacked.

Amygdala hijack is defined by Wikipedia as follows: Amygdala hijack is a term coined by Daniel Goleman in his 1996 book Emotional Intelligence: Why It Can Matter More Than IQ (1996). Drawing on the work of Joseph E. LeDoux (1996), Goleman uses the term to describe emotional responses from people which are immediate and overwhelming, and out of measure with the actual stimulus because it has triggered a much more significant emotional threat.

Stimulus from the thalamus goes to both the amygdala (the emotional brain) and the neocortex (the thinking brain). However, if the stimulus is a categorical match with a prior threat association, information travels faster to the amygdala and overrides the neocortex. In other words, threat messages are received faster and take priority, which can lead to reactions that may be inappropriate to the stimulus.

When the threat centres are activated by trauma, the amygdala triggers a 'fight-or-flight' response and sends alarm messages to the hypothalamus (the relay station in the brain) that then sends messages to the adrenal glands (near the kidneys) to release adrenaline into the bloodstream. When a stress response is chronic, it releases a constant stream of stress hormones into the body that can further damage the brain.

Overactivation of threat, survival, and protective mechanisms can also lead to hyperactivity within the amygdala and a misinterpretation of threat-related stimuli. The anterior cingulate cortex becomes overly focused on the threat potential of

stimuli. The inadequate function of the anterior cingulate cortex adapts to this dysfunction, resulting in the inaccurate evaluation of other stimuli as potential threat. This, in turn, influences hippocampal function in its explicit memory capability and its ability to identify safe contexts. This response to stimuli is not processed at a conscious level.

There is strong evidence that the amygdala can trigger a full-scale threat response without conscious awareness of threat related stimulus (Gilbert, B., 2010). Commonly, limbic system conditions are characterized by amygdala hyperactivity, anterior cingulate deficiency, hippocampal deficiency, and a heightened stress response.

This cascading stress response can trigger the hypothalamus to release specific neurotransmitters that may keep the brain and body in a chronic state of stress which, in turn, can negatively affect multiple systems.

In a limbic system trauma loop, the hypothalamus releases stress hormones, the amygdala is activated in a fear/ protective response, the cingulate cortex focuses the brain on the perceived threat, and the hippocampus keeps track of the experience for future reference and protection.

Anatomical connections between the amygdala, hippocampus, and hypothalamus facilitate the activation of the limbic-hypothalamic-pituitary-adrenal axis or HPA axis. Sensory information arriving in the amygdala is processed and conveyed to several parts of the brain involved with responses to fear. Overactivation of the threat mechanisms cause a chronic stress response resulting in HPA hyper-reactivity. The HPA axis controls reactions to stress and regulates many body processes, including digestion, the immune system, mood and emotions, sexual arousal, and the storage and expenditure of energy. Chronic activation of the HPA axis causes increased production of stress hormones that perpetuate a negative feedback loop. As the brain is constantly taking cues from the body, the chronic release of stress hormones keeps the brain in a 'fight-or-flight' state. This adaptive response to trauma is referred to as a limbic system trauma loop.

Over time, the chronic activation of the threat response becomes automatically wired in the brain. This speaks to Canadian psychologist Donald Hebb's great contribution to the understanding of neuroplasticity: "neurons that fire together-wire together" (1949). Basically this means that neurons that coactivate at any given time will do so automatically with repetition. This is at the foundation of all learning. But in the case of a limbic system trauma, this is also at the root of much suffering. The sensitivities that develop through the reinforcement of the trauma loop can also spread to other forms of sensory stimulation.

A process of sensitization, called 'kindling,' often occurs where sufferers will find themselves reacting to lesser amounts of stimuli and more classes of chemical substances (e.g., synthetic fragrances, smoke, pesticides, etc.) and may even progress to natural or inert substances by unconscious association (flowers, essential oils, or

food smells). The sensitivities can also spread to other forms of sensory stimulation such as touch, hearing, sight (light sensitivity), and food.

With a compromised limbic system, the threat mechanisms of the brain are constantly on high alert and with specific exposures, are launched into an extreme aversion reaction. A minute amount of stimuli can throw the whole system into a five–alarm stress response. Because the threat mechanism is triggered by toxicants in the environment, the patient will naturally learn to avoid triggers in a protective response. While we understand that environmental toxins can be the cause of limbic system injury, it is important to note that the injury itself can cause altered sensory perception and lead to a negative feedback loop.

Once in survival mode, the limbic system reacts by physically focusing the body's energy on survival. Energy is taken away from other mechanisms associated with growth and regeneration, like communication between cells, absorption of nutrients, production of energy, excretion of waste products, or rest. Research has shown that chronic or excessive stress inhibits synaptic function and neuronal growth.

This trauma cycle keeps the individual in a state of physiological 'emergency' that involves the central nervous system and the musculoskeletal system as well as the respiratory, gastro-intestinal, immunological, and endocrinal systems, causing a range of physical symptoms that are often disabling. It can also keep the individual in a state of hyper-vigilance and focused on personal health and safety. The combination of the compromised functioning of the body's systems along with the symptomatic hyper-focus on health and protection can leave the patient in a state of physical, emotional, and psychological crisis.

In a nutshell, this means that the brain and body unconsciously get stuck in a permanent 'fight-or-flight' response. In this emergency state, the brain perceives a constant threat akin to being hunted by a ferocious tiger, even if there is no tiger. When suffering from a limbic system injury, the brain can be sending the body false messages about threat perception, pain, and distorted sensory perception.

It is thought that the pathogenesis of limbic system dysfunction that is associated with many chronic illnesses is caused from trauma to the brain that affects self-protective mechanisms which overactivates fear centres of the brain that leads to a chronic stress response. Over time, chronic overactivation of the fear centres in the brain can structurally change the brain and thus its function. This can also lead to altered sensory function and perception. In some ways, these illnesses are much like post-traumatic stress disorder (PTSD). With PTSD, the memory of a trauma does not shift into the past; rather, the person relives the trauma on a daily basis because their brain is stuck in a trauma pattern.

There is considerable overlap between PTSD and many other limbic system-related illnesses like multiple chemical sensitivities, chronic fatigue syndrome, fibromyalgia and electric hypersensitivity syndrome. With PTSD, the involved trauma is most often

triggered by a severe psychological event. The brain is so overwhelmed at the time that it does not have the capacity to file the event into the past, causing a disorganization of neural networks during an extreme stress situation (Rauch, S. L., Shin, L.M., Wright, C., 2003). Many other limbic system conditions are similar in nature to PTSD in that during the initial trauma, the brain cannot filter the incoming information and gets stuck in a trauma cycle. This can affect perception and the ability to evaluate incoming sensory information. Some people are more susceptible to this type of injury given their genetic makeup, which can alter detoxification pathways. However, whether the gene is present or not, the limbic system can still be rewired.

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Gus Speth JOYFUL ECONOMY Essay
<https://thenextsystem.org/the-joyful-economy>

Page 11

The good news is that we already know a great deal about the policy and other changes needed to move strongly in these directions.¹⁴ Even better, we are already seeing the proliferation of innovative models along many of the lines sketched here, particularly at the local level: sustainable communities, transition towns, solidarity and local living economies, sustainable and regenerative agriculture, new regional and organic food systems, locally owned and managed renewable energy, and community development and investment institutions. We are also seeing the spread of innovative business models that prioritize community and environment over profit and growth—including social enterprises, for-benefit business, worker-owned and other cooperatives, and local credit unions—as well as numerous campaigns for fair wages, worker rights, and pro-family policies.¹⁵ Together with new community-oriented and earth-friendly lifestyles, these initiatives provide inspirational models of how things might work in a new political economy devoted to sustaining human and natural communities. Practical utopians at work and play, bringing the future into the present!

Page 13

Two other key factors in cultural change are leadership and social narrative.

Howard Gardner has written:

Whether they are heads of a nation or senior officials of the United Nations, leaders . . . have enormous potential to change minds . . . and in the process they can change the course of history

I have suggested one way to capture the attention of a disparate population: by creating a compelling story, embodying that story in one's own life, and presenting the story in many different formats so that it can eventually topple the counterstories in one's culture. . . . The story must be simple, easy to identify with, emotionally resonant, and evocative of positive experiences.¹⁷

Bill Moyers, a powerful force for good in our country, has written, "America needs a different story. . . ."

The leaders and thinkers and activists who honestly tell that story and speak passionately of the moral and religious values it puts in play will be the first political generation since the New Deal to win power back for the people.”¹⁸

There is some evidence that Americans are ready for another story. Large majorities of Americans, when polled, express disenchantment with today’s lifestyles and offer support for values similar to those urged here.¹⁹ (Of course, respondents do not always act on the high-minded sentiments expressed to pollsters.)

Page 15

A major and very hopeful path is seeding the landscape with innovative, instructive models. As noted, there is a proliferation of innovative models of community revitalization and business enterprise. Local currencies, slow money, state Genuine Progress Indicators, locavores—these are bringing the future into the present in very concrete ways. These actual models will grow in importance as communities search for answers on how the future should look, and they can change minds. Seeing is believing.

In sum, cultural transformation won’t be easy, but it’s not impossible either.

Joy

Page 16

If incomes are such weak generators of well-being in our more affluent societies, what are the things that really do produce happiness and well-being? The answer is somewhat complicated, but when a founder of the field of positive psychology was asked to state briefly the lessons of positive psychology, his answer was: “Other people.”²⁷ We flourish in a setting of warm, nurturing, and rewarding interpersonal relationships, and within that context we flourish best when we are giving, not getting.
²⁷ Seigelman FLOURISH book different than the Flourish book i have.

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The art of abstraction. Quanta magazine article
Usain Bolt’s Split Times and the Power of Calculus
By STEVEN STROGATZ April 3, 2019

<https://www.quantamagazine.org/authors/stevenstrogatz/>

...**The art of abstraction** lies in knowing what is **essential and what is minutia, what is signal and what is noise, what is trend and what is wiggle**. It’s an art because such choices always involve an element of danger; they come close to wishful thinking and intellectual dishonesty. The greatest scientists, like Galileo and Newton, somehow manage to walk along that precipice.

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STAYING WITH THE TROUBLE: Donna J. Haraway

Haraway, Donna J.. Staying with the Trouble: Making Kin in the Chthulucene (Experimental Futures) (p. 1-4). Duke University Press. Kindle Edition.

Introduction

Trouble is an interesting word. It derives from a thirteenth-century French verb meaning “to stir up,” “to make cloudy,” “to disturb.” We—all of us on Terra—live in disturbing times, mixed-up times, troubling and turbid times. The task is to become capable, with each other in all of our bumptious kinds, of response. Mixed-up times are overflowing with both pain and joy—with vastly unjust patterns of pain and joy, with unnecessary killing of ongoingness but also with necessary resurgence. The task is to make kin in lines of inventive connection as a practice of learning to live and die well with each other in a thick present. Our task is to make trouble, to stir up potent response to devastating events, as well as to settle troubled waters and rebuild quiet places. In urgent times, many of us are tempted to address trouble in terms of making an imagined future safe, of stopping something from happening that looms in the future, of clearing away the present and the past in order to make futures for coming generations. Staying with the trouble does not require such a relationship to times called the future. In fact, staying with the trouble requires learning to be truly present, not as a vanishing pivot between awful or edenic pasts and apocalyptic or salvific futures, but as mortal critters entwined in myriad unfinished configurations of places, times, matters, meanings.¹

Chthulucene is a simple word.² It is a compound of two Greek roots (khthôn and kainos) that together name a kind of timeplace for learning to stay with the trouble of living and dying in response-ability on a damaged earth. Kainos means now, a time of beginnings, a time for ongoing, for freshness. Nothing in kainos must mean conventional pasts, presents, or futures. There is nothing in times of beginnings that insists on wiping out what has come before, or, indeed, wiping out what comes after. Kainos can be full of inheritances, of remembering, and full of comings, of nurturing what might still be. I hear kainos in the sense of thick, ongoing presence, with hyphae infusing all sorts of temporalities and materialities. Chthonic ones are beings of the earth, both ancient and up-to-the-minute. I imagine chthonic ones as replete with tentacles, feelers, digits, cords, whiptails, spider legs, and very unruly hair.

Chthonic ones romp in multicritter humus but have no truck with sky-gazing Homo. Chthonic ones are monsters in the best sense; they demonstrate and perform the material meaningfulness of earth processes and critters. They also demonstrate and perform consequences. Chthonic ones are not safe; they have no truck with ideologues; they belong to no one; they writhe and luxuriate in manifold forms and manifold names in all the airs, waters, and places of earth. They make and unmake; they are made and unmade. They are who are. No wonder the world’s great monotheisms in both religious and secular guises have tried again and again to exterminate the chthonic ones. The scandals of times called the Anthropocene and the Capitalocene are the latest and most dangerous of these exterminating forces. Living-

with and dying-with each other potently in the Chthulucene can be a fierce reply to the dictates of both Anthropos and Capital.

Kin is a wild category that all sorts of people do their best to domesticate. Making kin as oddkin rather than, or at least in addition to, godkin and genealogical and biogenetic family troubles important matters, like to whom one is actually responsible. Who lives and who dies, and how, in this kinship rather than that one? What shape is this kinship, where and whom do its lines connect and disconnect, and so what? What must be cut and what must be tied if multispecies flourishing on earth, including human and other-than-human beings in kinship, are to have a chance?

An ubiquitous figure in this book is **SF: science fiction, speculative fabulation, string figures, speculative feminism, science fact, so far**. This reiterated list whirls and loops throughout the coming pages, in words and in visual pictures, braiding me and my readers into beings and patterns at stake. Science fact and speculative fabulation need each other, and both need speculative feminism. I think of SF and string figures in a triple sense of figuring. First, promiscuously plucking out fibers in clotted and dense events and practices, I try to follow the threads where they lead in order to track them and find their tangles and patterns crucial for staying with the trouble in real and particular places and times. In that sense, SF is a method of tracing, of following a thread in the dark, in a dangerous true tale of adventure, where who lives and who dies and how might become clearer for the cultivating of multispecies justice. Second, the string figure is not the tracking, but rather the actual thing, the pattern and assembly that solicits response, the thing that is not oneself but with which one must go on. Third, string figuring is passing on and receiving, making and unmaking, picking up threads and dropping them. SF is practice and process; it is becoming-with each other in surprising relays; it is a figure for ongoingness in the Chthulucene.

The book and the idea of “staying with the trouble” are especially impatient with two responses that I hear all too frequently to the horrors of the Anthropocene and the Capitalocene. The first is easy to describe and, I think, dismiss, namely, a comic faith in technofixes, whether secular or religious: technology will somehow come to the rescue of its naughty but very clever children, or what amounts to the same thing, God will come to the rescue of his disobedient but ever hopeful children. In the face of such touching silliness about technofixes (or techno-apocalypses), sometimes it is hard to remember that it remains important to embrace situated technical projects and their people. They are not the enemy; they can do many important things for staying with the trouble and for making generative oddkin.

The second response, harder to dismiss, is probably even more destructive: namely, a position that the game is over, it's too late, there's no sense trying to make anything any better, or at least no sense having any active trust in each other in working and playing for a resurgent world. Some scientists I know express this kind of bitter cynicism, even as they actually work very hard to make a positive difference for both people and other critters. Some people who describe themselves as critical cultural theorists or political progressives express these ideas too. I think the odd coupling of

actually working and playing for multispecies flourishing with tenacious energy and skill, while expressing an explicit “game over” attitude that can and does discourage others, including students, is facilitated by various kinds of futurisms. One kind seems to imagine that only if things work do they matter—or, worse, only if what I and my fellow experts do works to fix things does anything matter. More generously, sometimes scientists and others who think, read, study, agitate, and care know too much, and it is too heavy. Or, at least we think we know enough to reach the conclusion that life on earth that includes human people in any tolerable way really is over, that the apocalypse really is nigh.

That attitude makes a great deal of sense in the midst of the earth’s sixth great extinction event and in the midst of engulfing wars, extractions, and immiserations of billions of people and other critters for something called “profit” or “power”—or, for that matter, called “God.” A game-over attitude imposes itself in the gale-force winds of feeling, not just knowing, that human numbers are almost certain to reach more than 11 billion people by 2100. This figure represents a 9-billion-person increase over 150 years from 1950 to 2100, with vastly unequal consequences for the poor and the rich—not to mention vastly unequal burdens imposed on the earth by the rich compared to the poor—and even worse consequences for nonhumans almost everywhere. There are many other examples of dire realities; the Great Accelerations of the post-World War II era gouge their marks in earth’s rocks, waters, airs, and critters. There is a fine line between acknowledging the extent and seriousness of the troubles and succumbing to abstract futurism and its affects of sublime despair and its politics of sublime indifference.

This book argues and tries to perform that, eschewing futurism, staying with the trouble is both more serious and more lively. Staying with the trouble requires making oddkin; that is, we require each other in unexpected collaborations and combinations, in hot compost piles. We become-with each other or not at all. That kind of material semiotics is always situated, someplace and not noplacely, entangled and worldly. Alone, in our separate kinds of expertise and experience, we know both too much and too little, and so we succumb to despair or to hope, and neither is a sensible attitude. Neither despair nor hope is tuned to the senses, to mindful matter, to material semiotics, to mortal earthlings in thick copresence. Neither hope nor despair knows how to teach us to “play string figures with companion species,” the title of the first chapter of this book.

Footnote



1 *Critters* is an American everyday idiom for varmints of all sorts. Scientists talk of their “critters” all the time; and so do ordinary people all over the U.S., but perhaps especially in the South. The taint of “creatures” and “creation” does not stick

to “critters”; if you see such a semiotic barnacle, scrape it off. In this book, “critters” refers promiscuously to microbes, plants, animals, humans and nonhumans, and sometimes even to machines.

Footnote



2 Less simple was deciding how to spell Chthulucene so that it led to diverse and bumptious chthonic dividuals and powers and not to Chthulhu, Cthulhu, or any other singleton monster or deity. A fas-

tidious Greek speller might insist on the “h” between the last “l” and “u”; but both for English pronunciation and for avoiding the grasp of Lovecraft’s Cthulhu, I dropped that “h.” This is a metaplasm.

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JOURNEY TO EARTHLAND. Paul Raskin

Imagine all the people

Can a “global citizens movement” for a Great Transition take shape at the requisite speed, scale, and coherence? The race for the soul of Earthland is on. Disturbing omens abound, yet spreading awareness and broadening engagement hint that a systemic movement may be gestating. The question becomes how to help bring it into the world and give it life. The generative factors—**system vulnerability, organizational capability, and cultural solidarity**—at play in triggering movements of the past will need to align in the requisite dynamic for a vital GCM to take shape in the coming years.

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Ben Note to self: The issue is visualizing the causality of molecular work and how we are completely intertwined with this not separate by a molecular nano bit of space.

Make the physics real.6May2019

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Book: THE PHYSICS OF TIME TIME & ITS ARROWS IN QUANTUM MECHANICS, RELATIVITY, THE SECOND LAW OF THERMODYNAMICS, ENTROPY, THE TWIN

PARADOX, & COSMOLOGY EXPLAINED VIA LTD THEORY'S FOURTH EXPANDING DIMENSION by Dr. Elliot McGlucken

The great Albert Einstein stated:

The development of Western Science is based on two great achievements, the invention of the formal logical system (in Euclidean geometry) by the Greek philosophers, and the discovery of the possibility to find out causal relationships by systematic experiment (Renaissance).

Unfortunately, the string theorists, inflationists, and multimillionaire multiverse maniacs have abandoned both experiment and formal logic, alongside genuine, rugged, independent curiosity. In order to sustain their failed regimes, they exiled the two pillars of Western Science, alongside simple truth and beauty. And so it is that theoretical physics ground to a halt. Light Time Dimension Theory is built upon these two pillars of science—formal logic and empirical observation and bolstered by courage to ask, and answer, the most seemingly simple questions.

Albert Einstein: Curiosity has its own reason for existing. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery every day. Never lose a holy curiosity.

Galileo: For in the sciences the authority of thousands of opinions is not worth as much as one tiny spark of reason in an individual man. Albert Einstein: Any intelligent fool can make things bigger (the multiverse), more complex (the string theorists' landscape), and more violent (the multiverse televangelist's violence against simple Truth and Beauty). It takes a touch of genius—and a lot of courage—to move in the opposite direction ($dx^4/dt = ic$).

Albert Einstein: A theory is the more impressive the greater is the simplicity of its premises ($dx^4/dt = ic$), the more different are the kinds of things it relates (relativity, the quantum, time, dark matter, dark energy, entanglement) and the more extended the range of its applicability.

Introduction: What is Time?

Let us lead with the exalted words of some of the Greats! One thing you will notice about Dr. E's books is that I always begin by acknowledging the Giants upon whose shoulders I stand so as to see further.

J.A. Wheeler: How come time? It is not enough to joke that, "Time is nature's way to keep everything from happening all at once." A question so deep deserves a deeper look. Let's come back to it, therefore, towards the end of this account, and turn for now to the less intimidating, "How come the asymmetry between past and future?"

Sir Arthur Eddington: Time's Arrow. The great thing about time is that it goes on. But this is an aspect of it which the physicist sometimes seems inclined to neglect. In the four-dimensional world . . . the events past and future lie spread out before us as in a map. The events are there in..

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David MacKay. Sustainable Energy without the Hot Air

In a climate where people don't understand the numbers, newspapers, campaigners, companies, and politicians can get away with murder.

We need simple numbers, and we need the numbers to be comprehensible, comparable, and memorable.

With numbers in place, we will be better placed to answer questions such as these:

Can a country like Britain conceivably live on its own renewable energy sources?

If everyone turns their thermostats one degree closer to the outside temperature, drives a smaller car, and switches off phone chargers when not in use, will an energy crisis be averted?

Should the tax on transportation fuels be significantly increased?

Should speed-limits on roads be halved?

Is someone who advocates windmills over nuclear power stations "an enemy of the people"?

If climate change is "a greater threat than terrorism," should governments criminalize "the glorification of travel" and pass laws against "advocating acts of consumption"?

Will a switch to "advanced technologies" allow us to eliminate carbon dioxide pollution without changing our lifestyle?

Should people be encouraged to eat more vegetarian food?

Is the population of the earth six times too big?

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<https://www.lifeworth.com/deepadaptation.pdf> Jem Blendell

DEEP ADAPTATION: A Map for Navigating Climate Tragedy

Rather, I hope the deep adaptation agenda of **resilience, relinquishment and restoration** can be a useful framework for community dialogue in the face of climate change.

Resilience asks us “how do we keep what we really want to keep?”

Relinquishment asks us “what do we need to let go of in order to not make matters worse?”

Restoration asks us “what can we bring back to help us with the coming difficulties and tragedies?”

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LIFE: A NATURAL HISTORY OF THE FIRST FOUR BILLION YEARS OF LIFE ON EARTH. by Richard Fortey.

My tale stops where civilization starts, and where prehistory blurs into history. This is the moment when records begin, when humble steles or grandiose monuments tell of mankind’s inhumanity, or his aspirations to godliness. Appropriately enough, some of the earliest writing is biographical, inscriptions trumpeting the achievements of kings. The truth of a life also depends on the selection of its incidents, no less than does an account of a civilization. As such unnatural selection proceeds there is also the possibility of lies and unwitting deception; although Nature is full of camouflage, we are the first animal ever to deceive ourselves.

A review of the history of life should provoke awe, above all else. As Goethe said, “Zum Erstaunen bin ich da” —I am here to wonder. There are no trite moral lessons, nor are homilies desirable about cycles of history which are destined to come around once more. It is only certain that there will be change, and change again. Man will doubtless be an additional cause of it. The difference from any of the hundred incidents I have described in this biography is that we should be able to anticipate effects. Let us hope that we act wisely. Spinning tumblers, geared by chance, will still intercede in our fate. There may be bolides, there will certainly be climate change, there may be incidents with no precedents. Life will probably cope.

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Footnote in BLESSED UNREST by Paul Hawkin

25. After I had written this passage, I saw a better list from David James Duncan’s book *God Laughs and Plays* (Great Barrington, Mass: Triad, 2006): “I hold the evangelical truth of the matter to be that contemporary fundamentalists, including first and foremost those aimed at Empire and Armageddon, need us nonfundamentalists, mystics, ecosystem activists, unprogrammable artists, agnostic humanitarians, incorrigible writers, truth-telling musicians, incorruptible scientists, organic gardeners, slow food farmers, gay restaurateurs, wilderness visionaries, pagan preachers of sustainability, compassion-driven entrepreneurs, heart-broken Muslims, grief-stricken

children, loving believers, loving disbelievers, peace-marching millions, and the Ones who love us all in such a huge way that it is not going too far to say they need us for their salvation.”

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Book: CONFESSIONS OF A RECOVERING ENVIRONMENTALIST AND OTHER ESSAYS BY Paul Kingsnorth. Co-founder of DARK MOUNTAIN

The Eight Principles of Uncivilisation

We must unhumanize our views a little, and become confident As the rock and ocean that we were made from. Robinson Jeffers

We live in a time of social, economic and ecological unravelling. All around us are signs that our whole way of living is already passing into history. We will face this reality honestly and learn how to live with it.

We reject the faith that holds that the converging crises of our times can be reduced to a set of ‘problems’ in need of technological or political ‘solutions’.

We believe that the roots of these crises lie in the stories we have been telling ourselves. We intend to challenge the stories that underpin our civilisation: the myth of progress, the myth of human centrality, and the myth of our separation from ‘nature’. These myths are more dangerous for the fact that we have forgotten they are myths.

We will reassert the role of storytelling as more than mere entertainment. It is through stories that we weave reality.

Humans are not the point and purpose of the planet. Our art will begin with the attempt to step outside the human bubble. By careful attention, we will re-engage with the non-human world.

We will celebrate writing and art that is grounded in a sense of place and of time. Our literature has been dominated for too long by those who inhabit the cosmopolitan citadels.

We will not lose ourselves in the elaboration of theories or ideologies. Our words will be elemental. We write with dirt under our fingernails.

The end of the world as we know it is not the end of the world full stop. Together, we shall find the hope beyond hope, the paths that lead to the unknown world ahead of us.

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"Falter: Has the Human Game Begun to Play Itself Out?" by Bill McKibben

"Climate change is not a normal political negotiation between different interests, where compromise makes obvious sense. Climate change is a negotiation between human beings and physics, and physics doesn't compromise. Past a certain point, there's no more room for maneuver."

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BOOK: There is no Planet B: The Make or Break Years. By Mike Berners-Lee

We need thinking skills and habits that fit the twenty-first century context of enormous human power and technology on a now-fragile planet. We've also seen the global interconnectedness of just about everything we do. It is not at all surprising that ways of thinking that have taken us to this place might not be the same ones that will help us to live well now that we have got here. **The brain skills that we developed over the millennia as we expanded on a big, robust world are not the same as the ones that will let us do well on the small delicate spaceship on which we now find ourselves.**

What new ways of thinking do we need in the twenty-first century?

- (1) Big picture perspective.
- (2) Global empathy.
- (3) Future thinking.
- (4) Appreciation of the simple, small and local.
- (5) Self-reflection.
- (6) Critical thinking.
- (7) Complex and complicated thinking.
- (8) Joined-up perspective.

We humans urgently need to develop our thinking skills and habits in at least eight respects

These include big picture thinking, joined up thinking, future thinking, critical thinking, dedication to truth, self-awareness, global empathy, and a better appreciation of the small things in this beautiful world that we live in.

How can I help to create the conditions under which the world that I want to see becomes possible?

summary bullets.

Develop the eight twenty-first century thinking habits and skills as best you can. Encourage our kids to do the same.

Support politicians who demonstrate these habits and skills. Reject those who don't. Be discerning about the difference.

Be as discerning and critical as you can when choosing who and what to believe. Insist on truth everywhere. Reject politicians, businesses and media sources that don't do likewise. Let them and others know that this is what you are doing. Take all this to your workplace and your ballot box. Take it with you to the shops and every time you spend money.

Be a role model for sustainable living as best you can –and find ways of doing so that make your life better:
find ways to consume less but appreciate more
be sparing with meat, dairy and waste
know your supply chains and support the ones you like every time you spend or invest.

Don't beat yourself up over your shortcomings but don't let yourself off the hook either.

Dream of the world you want to see. Share the dream and live for it.

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BOOK: LIBERATION SCIENCE book

Chapter 10: Geomimicry for Social and Environmental Justice by Marcia Bjørnerud

Summary Since the time of the industrial revolution, Western technology has been based on an implicit view of Nature as an adversary to be defied, circumvented, or hoodwinked. **After two hundred years of believing that we have outsmarted natural laws, we face the planetary-scale consequences of this adolescent attitude toward the Earth.** Environmental malefactions and social injustices are arguably both rooted in a distorted sense of the relationship between humans and the natural world. Ecological integrity and human rights are equally endangered when dogma, prejudice, greed and fear obscure **our shared past and common destiny**. Our collective survival now requires that we learn some humility and study Earth's own history for models of dynamic and durable systems.

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Recasting decisions in terms of time scales longer than a single human lifetime requires a consideration of environmental and geologic factors that are easily forgotten on a day-to-day basis. Fiscal years and congressional terms enforce a blinkered view of the future; few modern political entities are configured to make plans on the scale of decades, much less generations. The single most important contribution of geology to the environmental justice movement, then, may be to instill in politicians, CEOs, and ordinary citizens **an altered perception of time**. So what can Earth teach us about building systems with longevity and durability? And how can these geocentric operating principles be translated into policies that will take root in our economic and political systems and produce measurable benefits? **By respecting and obeying geological "laws," rather than trying to evade or circumvent them, we may**

discover untapped reserves, within ourselves, of fairness, frugality, resourcefulness and common sense.

Geomimetic Principles for Social Justice

Principle #1: Uniformity of laws

Principle #2: Loopiness

Principle #3: Nestedness

Principle # 4: Microcracy

Principle #5: Historicity and causality

By failing to understand time, we are stealing the future from those who will follow us.

More from this chapter

An understanding of the rock record makes it clear that in the long term, we really have no choice: Earth will be the ultimate designer and arbiter of human destiny. An irony of modern technology is that understanding natural laws well enough to build marvelous machines has caused us to believe that we are exempt from natural laws. Geological laws in particular, which are slow to have obvious manifestations, can seemingly be circumvented without consequences. A physical miscalculation may lead swiftly and catastrophically to a train derailment or plane crash, but breaking geologic rules rarely has such immediate repercussions. Geological jurisprudence is ubiquitous but largely invisible—the very framework of our existence, and therefore transparent to us. This blindness arises from our inability to see ourselves and the landscapes we inhabit in proper temporal perspective, to recognize that the natural amenities we consider “givens”—**life-sustaining soil, water, and ecosystems**—*are not fixed but, in fact, are fortuitous legacies of past geologic circumstance, without guarantees for the future.*

Our collective ignorance of natural history could be written off as harmless except that environmental malefactions and social injustices are arguably both rooted in a distorted sense of the relationship between humans and the natural world. Ecological integrity and human rights are equally endangered when dogma, prejudice, greed and fear obscure **our shared past and common destiny.**

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Bakke, Gretchen. BOOK: The Grid (pp. 291-292). Bloomsbury Publishing. Kindle Edition.

Any sufficiently advanced technology is indistinguishable from magic.—ARTHUR C. CLARKE

Afterword

Contemplating Death in the Afternoon

As I write this, the power is out. It's below freezing outside, though it's midafternoon on a sunny day in early spring. I have a couple of hours of battery power left in my computer. I was using it for most of the morning without having plugged it in, though there was an outlet less than a cord's length away. I am kicking myself for that now.

Despite my computer's pending demise, it's difficult to think of this power outage as a "blackout"—the house is flooded with sunlight. There is no hint of darkness. For the moment, at least, everything is fine, except perhaps a slight, nagging irritation that my singular task for the latter half of the day—writing approximately four thousand overdue e-mail replies—has just become impossible. No power, of course, means that there is no Internet, either.

Despite this now unavoidable failure of e-etiquette, I am mostly worried about the cold. It will be fine indoors for a couple of hours, but I have a child to feed and house at the end of the school day, and tonight's temperatures are heading to down into the teens.

Our heat is electric, our stove is electric, our hot water heater electric; I may be writing a book about the grid, but I, like almost everyone else, also have to live with it. It is my intimate. The grid's good days and its bad days structure my life, my capacity to work, my reputation, my ability to care for my family. Its material quirks form the undulations of my worry. And tonight, as the blackout becomes real, I'll wrap myself and the thickest of our blankets around my son's small body. As he sleeps, I'll read by candlelight a book about men slowly dying of thirst in the middle of the Pacific Ocean (not a happy story) and I'll wonder if this is us too. We live in a sea of electricity. Our grid, for now, is the means we use to bring this electricity home. It warms and nourishes us. It makes life in extreme environments like Fargo and Phoenix livable, even comfortable. Despite being surrounded by this abundance of power, if we cannot make the means to this electricity, more reliably our own, we, too, could die of "thirst." It does not matter how much water is in the sea, or how much electricity we generate, if that water is not drinkable and that electricity is not delivered.

I have written this book as an optimist, the dreams of a better future are so strong, so palpable, so motivating. And then the power goes out and I, like almost everyone else, don't have a backup system in place. No solar panels, no bank of batteries, no diesel generator, no gas heater, though I do have a rotary phone (this much I learned from the Straws). It's the second decade of the twenty-first century, in one of the richest countries in the world. It is time, I think, for us to do better than this.

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Review of HERE ON EARTH by Tim Flannery Australian Book Review

<https://www.australianbookreview.com.au/reading-australia/tim-flannery/here-on-earth-by-tim-flannery>

Review: Reading Australia: 'Here on Earth' by Tim Flannery

[Danielle Clode](#)

Literature has long provided a powerful outlet for the expression of our hopes and fears for an environmentally challenged future. In recent years, fictional depictions of the future have become increasingly dystopian, disturbed, and pessimistic – from Cormac McCarthy's *The Road* and Margaret Atwood's *MaddAddam* trilogy to Alexis Wright's *The Swan Book*.

If our fiction writers are burdened by a sense of impending doom, one might expect non-fiction writers to be even more negative, **weighed down by the exponentially expanding evidence for environmental devastation with little prospect of timely intervention.** In truth, there is much to be fearful about. And yet Tim Flannery, Australia's foremost environmental writer, reverses the trend with *Here on Earth*, offering what he terms 'an argument for hope'.

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Copper: Externality web page: <http://economicstudents.com/2013/06/global-warming-externalities-and-government-failure/>

The biggest government failure with an externality, however, is on greenhouse gases. Greenhouse gas pollution has the potential to cause major global climate change. Further, the pollution is not localised. The climate effects of carbon-based emissions are wide-spread and relatively slow.

To see why this matters, consider the problem of sulphur dioxide. This pollutant causes localised air pollution. Citizens living in polluted areas have a strong incentive to force the government to 'do something'. Thus, in 1990, the United States government introduced a 'cap and trade' scheme to limit sulphur dioxide emissions. And the scheme worked. By putting a price on these pollutants, the scheme created significant incentives to reduce pollution.

Similarly, broad support and government action on greenhouse gases is most likely **if there is a significant local problem.** China is looking to limit its import of low quality coal. But this policy is driven by the problems of local air pollution. It may lower global greenhouse emissions but that is a side benefit of dealing with a local problem.

Global warming is a global negative externality and, in my opinion, it is highly unlikely that governments in different countries will agree to an effective scheme to deal with this negative externality. Even if developed nations could reach an agreement, developing nations would be reluctant to join in. After all, how do we tell the 'bottom' billion in Asia and Africa to limit their economic growth in order to avoid a problem which, from their perspective, seems ephemeral.

There are no easy answers to dealing with global warming. And, given the poor history of governments dealing with localised externalities, I am pessimistic that they will put policies in place to deal with a global issue. Sadly, effective policies to deal with global

warming are only likely to gain political support when the problem becomes too big for it to be ignored at the local level.

Climate change is a result of the greatest market failure that the world has seen, Sir **Nicholas Stern**, whose review last year warned of the economic and social costs of climate change, said tonight.

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From: The Guardian

<https://www.theguardian.com/environment/2007/nov/29/climatechange.carbonemissions>

Sir Nicholas used the RES lecture - entitled, Climate Change, Ethics and the Economics of the Global Deal - to set out a six-point global deal for tackling climate change.

The first involves rich countries reducing their greenhouse emissions by at least 80% - either directly or through trading schemes - in order that the overall 50% reduction in global emissions by 2050 is met.

Secondly he called for substantial trade between countries, including rich and poor countries, in greenhouse gas emissions.

The third point requires a major reform of the clean development mechanism, a Kyoto protocol mechanism that allows developing countries to sell emission reductions, but does not penalise them for emissions themselves, making it a "one-sided trade mechanism", said Sir Nicholas.

He also argued for an international programme to combat deforestation, which contributes 15-20% of greenhouse gas emissions.

"For \$10-15bn (£4.8-7.2bn) per year, a programme could be constructed that could stop up to half the deforestation," he said.

There also needs to be urgent promotion of rapid technological advance for climate change mitigation, said Sir Nicholas.

Carbon capture and storage (CCS) for coal is particularly urgent since coal-fired electric power is currently the dominant technology round the world and emerging nations will be investing heavily in these technologies, he said.

"For \$5bn a year, in terms of feed-in tariffs (which could be reduced as carbon prices rise), it should be possible to create 30 commercial scale coal-fired CCS stations within seven or eight years. Unless the rich world demonstrates, and quickly, that CCS works, developing countries cannot be expected to commit to this technology."

The final plank in Sir Nicholas's action plan is for rich countries to honour their commitments to 0.7% of GDP in aid by 2015. This would yield increases in flows of \$150-200bn per year. The extra costs developing countries face as a result of climate change are likely to be upwards of \$80bn per year and it is vital that extra resources are available for new initiatives.

Sir Nicholas argued that this global deal invokes effectiveness, efficiency and equity.

"The problem is deeply inequitable with the rich countries having caused the bulk of current stocks of greenhouse gases and the poor countries being hit earliest and hardest - which means that the rich countries must take the lead," he said.

"Within different countries, there will be different choices of instruments - such as taxes, trading and standards - and different technological mixes.

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from Book "Developing Ecological Consciousness: The End of Separation" by Christopher Uhl

Developing Ecological Consciousness is a marked departure from those standard environmental studies texts strongly focused on actions that humans need to take to fix the environment. Christopher Uhl explores the path to living in harmony with Earth, and believes it begins — not with *fixing* the environment — but with *fixing* ourselves — specifically our perceptions about Earth.

a part of, not *apart from* Earth. Indeed, at every level, from the sub-atomic to the cosmic, it is an interdependent relationship that defines reality.

Developing Ecological Consciousness successfully exposes the realization that must take place in order to rejoin the community of life; after all, the world was not made for us, but rather, it is we who have been made for the world.

Book footnoted [I think] “3. David Abram, *Becoming Animal: An Earthly Cosmology* (New York: Pantheon Books, 2010), 59. 4. Abram, *Becoming Animal*. 5. Abram, *Becoming Animal*, 101.”

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The Energy Debate We Aren't Having. Article by Lisa Margonelli Mar 5, 2013 in iBooks

Citibank's Morse puts a fine point on it: "We're a pluralistic government designed to prevent decisionmaking. Pluralism and sharing powers makes for incoherence," he says. And because no one can make any sudden moves, incoherence makes, ironically, for inertia—i.e., more drilling—which is good for investors. "I like the incoherence," he adds.

Incoherence may be great for some players in the economy, but it's a sorry *modus operandi* for a democracy. Smith lays out the new reality: the 2010 Gulf of Mexico disaster was far larger than the Santa Barbara or Alaska oil spills, but it failed to create

legislation or long-lasting political change. "Part of it was the lack of images and part was the speed of the media. In the old days there were fewer issues, fewer channels, and the public would mull over issues longer. Now we churn over issues much more quickly." In the speed of our political cogitation, we're a neurotic pile of contradictions, and at the end of the day we fall back on the couch, too exhausted and confused to make changes. **Incoherence, after all, allows us to be against fracking while being for the gasoline in our cars and the natural gas in our homes.**

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The energy boom has the nation mired in chatter about a burgeoning job market, or panicked over certain environmental destruction. Instead, we should be asking: To whom will go the spoils of this bonanza, and on whose shoulders will the risks fall?

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New Yorker Article

FORT MCMURRAY AND THE FIRES OF CLIMATE CHANGE

By Elizabeth Kolbert May 6, 2016

As Andrew Weaver, a Canadian climate scientist who is a Green Party member of British Columbia's provincial legislature, noted, "The reality is we are all consumers of products that come from oil."

But to fail to acknowledge the connection is to risk another kind of offense. We are all consumers of oil, not to mention coal and natural gas, which means that we've all contributed to the latest inferno. We need to own up to our responsibility, and then we need to do something about it. **The fire next time is one that we've been warned about, and that we've all had a hand in starting.**

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From DOUGHNUT ECONOMICS By Kate Raworth

Today's economy is divisive and degenerative by default. **Tomorrow's economy must be distributive and regenerative by design.**

An economy that is distributive by design is one whose dynamics tend to disperse and circulate value as it is created, rather than concentrating it in ever-fewer hands. An economy that is regenerative by design is one in which people become full participants in regenerating Earth's life-giving cycles so that we thrive within planetary boundaries. This is our generational design challenge, and its possibilities are explored in Chapters 5 and 6. But what kind of systems-thinking economist can help to make it happen?

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From book LYNN MARGULIES: The Life and Legacy of a Scientific Rebel Edited by Dorian Sagan. Chapter No Subject Too Sacred by JOANNA BYBEE

In a BBC interview, Dorian Sagan spoke of Lynn's courage: I think she had a sort of a congenital lack of fear. Her symbiosis theory was made as a young woman and so it emboldened her and it bolstered her in continuing to press the envelope and what she

thought was right and true based on the evidence. She looked at things herself and she was often right where other people were wrong. Galileo said something very similar about a single scientist in his basement working diligently [and his results] being worth more than the received consensus of all the others. 3

Asked once why there was a scientific backlash against her symbiogenesis theory, she replied: I'll tell you why, there are a lot of reasons. Some of them are just our language and some of them took me years to realize because I was taught the same language as everybody else. It's a representation of the paradigm just like reciprocal altruism and fitness and the parental investment of male children are indicative of this neo-Darwinist paradigm. Neo-Darwinists are people who emphasize individual differences, selection of individuals, which make us people nuts because an individual can't even reproduce, right? It's a system of looking at the world and it's reflecting Victorianism, nineteenth-century capitalism versus communism.

The interview continued: "What is it about symbiosis that people don't like, [do] they think it's this leftist conspiracy?" Lynn replied, "It's female. [It] is cooperative and noncompetitive. Doug Caldwell did an analysis of the Origin of Species and the numbers of times that competition, struggle, fight to death, these words, it's something like 10,000 to 1." She continued, "I think that monarchy and monotheism that is deep within our culture, your culture more than mine, I mean the monarchy part, that when they talk about monophyly in biology which means one single ancestor, it's just an extrapolation from monarchy and monotheism. Not only did she disagree with the conventional model of evolution—diversification of species resulting from the accumulation of beneficial genetic mutations—that neo-Darwinists such as Richard Dawkins champion, she abhorred the idea that an individual's genome, let alone individual genes, were considered the unit of evolution. For her it was cells, all the way down. Cells were the minimal unit of evolution. They speciated and diverged, but they also merged, as did organisms made of them, and populations and communities."

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From the book OXYGEN The Molecule That Made The World by Nick Lane

"One of the difficulties that scientists face today is the sheer breadth of knowledge. Even within a particular field, such as medical research, it is hard to keep abreast of new research, while spending most working hours at the bench or in the clinic. Researchers typically have a minutely detailed knowledge of their own immediate discipline, for example population genetics, while maintaining enough of a broad understanding to weigh up the importance of developments in related subjects, such as molecular biology. Once we get further afield, however, scientists, like everyone else, just have to accept a lot on trust. Fire gives an idea of just how deeply a concept can become embedded in scientific lore without anybody questioning its experimental basis.

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The mechanism hinges on an invisible thread of reactions,....

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**From Book Designing for the Circular Economy Edited by Martin Charter
Who Is Mining The World? Chapter 31 by Duncan Baker-Brown**

CONCLUSION

One theme that links the case studies discussed above is the depth to which the architects and designers have understood the supply chain associated with the projects. The case studies discussed above is extremely important, not least for cleaning up the natural world humans have polluted, and they are often closed-loop systems of sorts. However, **a truly Circular Economy requires new intelligent materials with clean end-of-life strategies, as well as new products designed for perpetual remanufacture.** The author believes that there is only one way to achieve this ambition, and that is by mobilising designers of all kinds to create the systems, materials, products and buildings that can be designed for perpetual re-use or the enrichment of our ecosystems.

Obviously this cannot be the sole responsibility of architects and designers, not least because it will be chemists and materials scientists who pioneer the production of new materials to replace plastics and other materials without an end-of-life strategy. However, it is architects who specify the material and systems that constitute the buildings they design. Architects literally construct their buildings one brick, beam, window, etc. at a time in their minds, their drawings, specifications and now in their BIM [Building Information Modeling] models. With this knowledge, they are best placed to unpack these same buildings one day for re-use. In short, architects have the knowledge. However, the author believes it can only happen if all designers rethink their own practices and design products, buildings, etc. that are able to be a genuine resource for the future. For these to be part of a Circular Economy, their constituent parts must have an end of-life strategy that sits in either the 'bio-sphere' (re-use or compost) or 'tech-sphere' (perpetual re-use of toxic and synthetic materials). Meanwhile, humans need to test the concepts discussed in this chapter by completely re-designing new systems, new materials and new products that allow us to perform as the rest of the natural world does, i.e. where one system's waste, is food for another.

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FROM THE BOOK YOUR ATOMIC SELF by Curt Stager

This, then, is why you breathe. You stoke the machinery of your cells with air, carry the watery leftovers around for a time, and then release them back into your surroundings through sighs, sweat, tears, and more substantial wastes. In doing so you split a flame's oxidation of carbon and hydrogen into two separate processes, thereby creating situations in which only metaphorical fires of life will flicker. The atmosphere literally becomes a part of you every time you draw a breath, and part of you returns to it on every outgoing breath as well.

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From GLOBAL FEVER by William Calvin

End Note:

READ WIDELY *When undertaking this book on our global fever, I decided to write a cheerful book in parallel.* It became *Almost Us: Portraits of the Apes*. You might wish to employ a similar back-and-forth strategy when reading more about our big problem. If you haven't already, I'd suggest reading:...

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<https://www.heraldtribune.com/article/LK/20100112/news/605199447/SH/>
<https://www.heraldtribune.com> › article

On average, a person at rest takes about 16 breaths per minute. This means we breathe about 960 breaths an hour, 23,040 breaths a day, 8,409,600 a year. Unless we get a lot of exercise. The person who lives to 80 will take about 672,768,000 breaths in a lifetime. Jan 12, 2010

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From the book FALTER by Bill McKibben

“Alun Hubbard, a Welsh scientist, conceded that there were limits to what instruments could explain. “It’s just gobsmacking looking at the trauma of the landscape,” he said. “I just couldn’t register the scale of how the ice sheet had changed in my head.”

But artists can register scale. They can transpose the fact of melting ice to inundated homes and bewildered lives, gauge it against long history and lost future. Science and economics have no real way to value the fact that people have lived for millennia in a certain rhythm, have eaten the food and sung the songs of certain places that are now disappearing. **This is a cost only art can measure, and it makes sense that the units of that measurement are sadness and fury—and also, remarkably, hope.** The women’s poem, shouted into the chill wind, ended like this:

Life in all forms demands The same respect we all give to money ... So each and every one of us Has to decide If we Will Rise

And so, we must—in fact, this book will end with a description of what that rising might look like. But if, as now seems certain, the melt continues, then the villages of the Marshalls and the ports of Greenland will be overwhelmed.”

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From ENDS OF THE WORLD by Peter Bannen

“It is from this disorienting perspective that geologists operate: to them, millions of years run together, seas divide continents, then drain away, and great mountain ranges erode to sand in moments. It’s an outlook that’s necessary to cultivate if one wants to get a handle on the staggering depths of geological time, which recedes behind us

hundreds of millions of years and stretches out before us to infinity. If Olsen's attitude seems dispassionate in the extreme, it's a symptom of a lifetime's immersion in Earth's history, which is both vast beyond comprehension and, in some exceedingly rare moments, tragic beyond words."

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From LIVING OIL by Stephanie Merlanger

[A comment from Robert Bullard, about the south in USA] Environmental damage yet to come, without (current) aesthetic dimensions, does not stir up alarm or activate an ethic of care. This is one of the supposed pitfalls in trying to communicate the threat of global climate change—it still can't be seen or felt enough, the argument goes, at least not in the continental United States.

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From Atlantic Magazine TOO MUCH STUFF by Amanda Mull 24 May 2019

<https://www.theatlantic.com/health/archive/2019/05/too-many-options/590185/>

The global-manufacturing apparatus now has the capacity to churn out near-endless stuff. The industry's output has ballooned 75 percent since 2007 to \$35 trillion, according to one analysis, and millions of livelihoods depend on its continued growth.

link noted: <https://www.interactanalysis.com/new-report-shows-manufacturing-output-hit-35-trillion-in-2017-growth-forecast-to-continue/>

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from Temin, Peter. The Vanishing Middle Class (The MIT Press) . The MIT Press. Kindle Edition.

Piketty argued that Kuznets was living in a very unusual economic period during the years after the Second World War. Only in that period, Piketty observed, was the growth rate of income higher than the interest rate, promoting equality. Since then, the American economy reverted to its more usual pattern where the interest rate is larger than the growth rate. I argued on different grounds that the "golden age of economic growth" was unusual, that it was a protracted recovery from the preceding thirty years of war and depression.

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Neal, Lucy. Playing for Time: Making Art as if the World Mattered . Oberon Books. Kindle Edition.

From PLAYING FOR TIME Making Art as if the World Mattered

Rob Hopkins chapter

Perhaps one of the key parts of this has been how Transition has, from the start, consciously seen the arts as being central to its success. The arts can powerfully make

the kind of future we want to see become an actual reality around us. It can invite us to step across into the future. It can open us to new possibilities and it can celebrate and document what we're doing in playful and creative ways. Ultimately, it can spark change, and change is what we need right now.

What Transition does is to give that a narrative, a context.

From Beth Stratford chapter

To fully liberate ourselves from the growth fetish we'd need to address the **psychological drivers** that make us desire more things. This might turn out to be the biggest challenge of all. But some obvious first steps present themselves: reduce the inequality which fuels status competition and social anxiety; provide some respite from the onslaught of advertising; offer alternative forums through which people can express individuality and participate in community life, that don't depend on the consumption of material goods. Artists can help create such forums and to subvert and counter the messages of advertising.

We are unlikely to entirely eradicate our attachment to material goods – after all, goods have played an important role in communicating identity and value in cultures throughout history – but we may succeed in transforming this relationship into one with less disastrous consequences for the planet. This would be grown-up economics.

From Heather Ackroyd chapter

Perhaps, as described by climate scientist Mike Hulne, the uncomfortable reality that none of the global deployments of science, economics, international relations, diplomacy and politics have yielded the breakthrough needed on the global stage, needs to be faced:

Perhaps this particular way of framing climate change (as a mega-problem awaiting, demanding a mega-solution) has led us down the wrong road. By constructing climate change as the “mother of all problems” – perhaps we have out-manoeuvred ourselves.

Why We Disagree About Climate Change

Lucy R. Lippard, writer, art critic and activist talks of art as a ‘framing device for visual and/or social experience’ and describes how artists ‘slip between the institutional walls to expose the layers of emotional and aesthetic resonance in our relationships to the world’. She points out how the immensity of the topics being faced today require the space or place for encounter to be redefined, to present a set of multiple views.

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The ‘daisy chain’ analogy of interlinked long strands of singular flowers brings to mind the long stable chains of a singular chemical element that over billions of years has given rise to the ever-evolving complexity of life and the profound soul-searching of our contemporary age – carbon.

Perhaps living life on the precipice of a warming planet, close to the edge of midnight, feeling every molecule of being captured in a single glacial drip, seeing a common thread running from bacterium to elephants, through the whole of biological existence, where every living creature as described by Charles Darwin is 'a little universe, formed of a host of self-propagating organisms, inconceivably minute and as numerous as the stars in heaven', maybe this is the naked exposure as described by Lippard to the emotional and aesthetic resonance in our relationships to the world that some artists hold true to.

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FROM THE BOOK YOUR ATOMIC SELF The Invisible Elements That Connect You to Everything Else in the Universe. by Curt Strager

Whether you buy your oxygen in a bar or inhale it for free, the question remains: Why do you do it at all? Many early investigators thought that breathing was done merely to cool the "animal heat" of one's body, and that lungs were little more than air conditioners. The reality lies deep within the cells of your body, where the differences between combustion and respiration are also more clearly revealed.

* * *

The basic formula of "food plus oxygen yields CO₂ and water" that is often presented in textbooks seems to imply a direct connection between the gases that enter and leave your lungs, as though the metaphorical fires of life operate on the atomic scale precisely as real fires do. Many scientists foster this impression, sometimes to simplify concepts for nonspecialists, and sometimes because similar explanations led them astray earlier in their careers. A recent article on molecular physiology in *Science*, for instance, described how blood sugar is "burned" with oxygen, and college professors often suggest in their lectures that the carbon dioxide we exhale is an exhaust gas that forms when breath oxygen combines with sugary fuel in the furnaces of our cells.

The image is appealing, but it is also wrong. A closer look at the subject shows why fire doesn't perfectly illustrate your use of oxygen.

Fire does resemble a living thing in many ways. Both emit carbon dioxide and—strangely enough—water vapor. Although a rush of liquid water can extinguish a flame or drown a person, the gaseous form of water in a puff of smoke or a human breath has no such effects on its source. Flames and life are also alike in that both can be snuffed out if deprived of oxygen. The light and heat that emerge from a candle arise from the breaking of chemical bonds in wax molecules, and the warmth of your skin is related to the breaking of bonds in food molecules. But although the basic equations of combustion and respiration are similar, the processes at work in a fire differ from those that sustain you.

In a candle flame, oxygen gas from the surrounding air attacks the melting wax directly, tearing electrons away from fuel molecules in a swirl of glowing carbon-rich particles and partially ionized gases. When the gaseous body of a flame is hot, dense, and

ionized enough, as for example on the six-thousand-degree business end of an oxyacetylene torch, it is called a “plasma,” a term that also applies to the incandescent sphere of the sun. Plasma is the fourth state of matter, a dynamic complement to the more commonly recognized solid, liquid, and gas states, and it may well be the dominant readily visible form of matter in the universe because stars are made of it. Here on Earth, less ferocious kinds of fire unwind carbon-based fuels into simpler particles much like those from which they originated. For instance, the petroleum from which candle paraffin is made was built from carbon dioxide and water by light-harvesting algae. Burning a candle returns its carbon and hydrogen atoms to the atmosphere in the grip of oxygen as carbon dioxide and water molecules. It also unleashes the solar energy that originally bound those raw materials together into living tissues, and it does this so rapidly that temperatures inside the hottest parts of a candle flame can reach 2500 ° F.

Inside the controlled confines of your cells, however, oxygen gas is usually not so much a fierce lion as a well-trained house cat that waits to be fed. When hot wax breaks down in a candle flame, for example, oxygen gas swoops into the blaze and emerges with carbon and hydrogen atoms in its clutches. When carbon-rich food oxidizes in your body, those same two waste products (CO₂ and H₂O) are made in two separate processes. The oxygen gas that you inhale will not carry carbon atoms off in later breaths as it might if you were a candle. In the relatively tame habitats of your cells, oxygen specializes in capturing hydrogens instead. And fortunately for you, the production of energy by cellular respiration is slow and dispersed enough to warm you without immolating you.

To envision how this process works, it helps to use Albert Einstein’s technique of conducting “thought experiments” to let your imagination follow some oxygen molecules down your throat and into your lungs on your next breath. About three-quarters of the air that you have just inhaled consists of nitrogen molecules, none of which will serve you apart from helping to keep your lungs inflated. Your target is the 21 percent of air that consists of oxygen molecules, but you can only get at them by harvesting the whole mess, like scooping up piles of mixed jelly beans and then picking out the colors you prefer.

As your chest expands and air presses into it, the gas squeezes through bronchiole ducts as thin as a human hair into hundreds of millions of bubble-like alveoli that compose the pink spongy interiors of your lungs. Their combined absorptive surface area approaches 750 square feet, roughly equivalent to one-third of a singles tennis court. From there most of the air molecules work their way into narrow spaces between the alveoli, where blood capillaries gather them up. On that microscopic scale your blood resembles water crammed with translucent blobs of crimson Jell-O that can squeeze past an alveolus within less than a second as your lungs pulsate. Those red blood cells are fast-moving vehicles that can carry oxygen through hundreds of miles of vessels to destinations all over your body.

Meanwhile, carbon dioxide molecules that recently formed inside your cells stream out of your blood and into the alveoli. In all that confusion most of your newly inhaled oxygen is simply blown right back out of your lungs. Although wasteful in one sense, such inefficiency can be a good thing. Residual oxygen allows mouth-to-mouth rescue breathing to revive an unconscious person rather than asphyxiating them with carbon dioxide.

A pint of your blood can carry roughly one-fifth of a pint of oxygen gas, almost enough to sustain you at rest for one minute. But the supply runs lower along the journey from your lungs to your cells and back. By the time venous blood makes it back to your alveoli, it contains so little oxygen compared with the air in your lungs that the imbalance automatically drives the diffusion of more oxygen into your blood.

The primary goal of an oxygen molecule in your body, if molecules can be said to have goals, is to be dismembered inside of you. But if you could accompany it on its fatal trip to one of your cells, you would have to do so as a purely metaphysical being because, naturally, you couldn't be made of unshrinkable atoms and still be yourself, any more than a brick building could shrink to the size of a standard brick and still be recognizable. **Scaling the atomic realm up to match you would not work either, because everything around you in that fantasy world would then have to be moving unrealistically fast. An atom is about ten billion times smaller than you are, and an oxygen atom's trip from your heart to your hand would be millions of miles long on an equivalent human-size scale. The blood in the brachial artery of your arm covers this distance within a single second, so a person-size atom would have to travel faster than the speed of light to do the same, which Einstein's research on relativity showed to be impossible.**

Even without the improbable logistics of shrinking and growing involved, the atomic realm is much stranger than the ones most of us are used to. Atoms are so mobile and the outer boundaries of their electron clouds so unstable that the atomic surfaces of objects are more indistinct than firm. In that world of the incredibly small there is no air to breathe, no sound to hear, and visible light cannot illuminate objects as it does in our much larger size range.

Nonetheless, here is an example of what you might imagine seeing and feeling in a thought experiment if a single skin cell were magically inflated ten million times into a living hill three hundred feet high so you could more easily see what happens to oxygen inside of it. At that magnification the sizes of the atoms making up the cell approach those of sand grains, and the body that you normally occupy would be large enough to lie down with your head in New York, your waistline atop the Pacific Ocean, and your feet in Australia.

You will now need to enter that hill by forcing your way in through the pliant, oily membrane. It is wet in there, so suspend disbelief even further and assume that you can still breathe despite the syrupy substance that fills the cell. The scene looks

positively industrial. Structural protein cables as thick as your arm stretch in all directions, giving the cell its shape.

Just over there is your destination—a cylindrical bubble-like thing that is roughly the size of a tractor trailer truck. This is a mitochondrion, a living power plant that uses food as a fuel. Each of your cells may contain dozens to hundreds of these, and they can vary in shape from peas to noodles. It is within such mitochondria that your breath oxygen meets its doom.

Enzymes in the cell and the core of the mitochondrion smash food molecules into a rich stew of electrons, hydrogen ions, and CO₂. The electrons are then fed to a series of proteins that lie embedded in a soft membrane surrounding the core, some of which will twitch, bend, or roll as the electrons pass through them. And as the molecular machinery churns, it also stores chemical energy that can power muscles and metabolism. In other situations it can help to generate body heat instead.

At the end of the line, each exhausted electron makes one last jump to clear the way for the ones coming up behind it. And here is the precise point from which your need for oxygenated air arises.

Oxygen uses those leaping electrons to tether the hydrogen ions from shattered food molecules to itself. In this transmutation of food and air, disparate components of your meals and breaths recombine to create H₂O molecules, your own homemade metabolic water. A tenth of the fluid in your body, from the blood in your veins to the moist gleam in your eyes, is built from scratch this way with the aid of oxygen that you inhaled during the last few days. Air and water are therefore more closely related to one another than the alchemists ever imagined, as each can represent a reconfiguration of the atoms of the other.

This, then, is why you breathe. You stoke the machinery of your cells with air, carry the watery leftovers around for a time, and then release them back into your surroundings through sighs, sweat, tears, and more substantial wastes. In doing so you split a flame's oxidation of carbon and hydrogen into two separate processes, thereby creating situations in which only metaphorical fires of life will flicker. **The atmosphere literally becomes a part of you every time you draw a breath, and part of you returns to it on every outgoing breath as well.**

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{KEY POINT HERE}: Writing this book has been a personal exploration for me as well. It isn't easy, even for a scientist such as myself who studies the interactions among species, climates, and the elements of life, to connect the invisible to the tangible when I flop onto the couch after a long day at the office or take a walk in the woods. It can be surprisingly difficult to think of oneself as a lump of inanimate matter as well as a person and, truth be told, I have yet to hear many scientists say that they really feel, in their heart of hearts, that they are made of atoms even though they may be able to discuss that fact in depth on an

intellectual level. But I assure you that even a fleeting glimpse of this miraculous truth can change you forever, and for the better.

and more from Stager, Curt. *Your Atomic Self: The Invisible Elements That Connect You to Everything Else in the Universe* (pp. 8-9). St. Martin's Press. Kindle Edition.

[the longest excerpt, i think]

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[about **phosphorus**]

If any element is going to hold back the tide of human population growth, it must either be rarer or more difficult to harvest than iron. It should be indispensable to us, and it should also be sought by other life forms, which could compete with us in order to get it. It should not be a mobile gas that disperses easily through the atmosphere, and to top off the list, it ought to be easily wasted and lost through carelessness.

Phosphorus fits that description, and forward-looking experts have already begun to warn of impending shortages of it. You carry about a pound of the element inside of you, mostly in your bones but also in many vital components of your cells. Like oil, phosphorus is a finite resource that, sooner or later, may constrain our numbers. And like any element of life, when overused or abused it can also become an agent of death.

To better understand why phosphorus is so important, a closer look at your atomic self is helpful. Starting with a look in a mirror, you can easily come face to face with the phosphorus in your body simply by studying your own reflection.

* * *

When you look at your face in a mirror, most of what you see is skin. The fleshy contours are wrapped in thin sheets of cells like the skin of a grape—or perhaps a raisin, depending on the age and condition of your face. An average adult wears eight to ten pounds of skin overall, and most of its weight comes from water and oils. But what you see most obviously in a mirror are the dried remains of epidermal cells in the outermost layers of your skin. If you could peer down through that thin, flaky barrier into the underlying tissues to examine the membranes surrounding the living cells, you would see that much of what you expose most prominently to the world is your phosphorus.

Strictly speaking, it is not only phosphorus atoms but more complex molecules of phosphate that surround your cells. Phosphate resembles a clump of balloons tethered close to a fist, with four oxygen atoms for balloons and a phosphorus atom for the fist. The strings holding the balloons are covalent chemical bonds, and the whole unit can tie itself to other molecules, including oils or additional phosphates. This flexibility in partners is critical to keeping you alive and recognizable. And sometimes, when life and death are less pressing issues, it also helps to keep your shirts clean.

Remember the eutrophication of waterways due to phosphate detergents? One reason why those detergents are algal fertilizers is because they resemble the phosphate-rich molecules in cell membranes. Take your own membranes, for instance. Every cell in your body is shrink-wrapped in a double layer of phosphates with oily substances sandwiched in the middle. This is not a solid barrier but a semipermeable, flexible one that forms spontaneously when exposed to water, a self-assembling feature with an odd molecular structure.

A phospholipid membrane molecule is like many of the strange composite creatures of ancient mythology, the mermaids and centaurs of old. To build it you snap a phosphate “head” onto one or more fatty acid “tails” of carbon and hydrogen atoms. The slightly charged heads attract water molecules, but the greasy tails prefer to mingle with their own kind. When you mix enough phospholipids into the wet medium that a cell inhabits, they align themselves into orderly ranks with their heads facing the water on both sides of the membrane and their tails packed inside like butter between two slices of bread. The epidermal surfaces of your cheeks, then, are crowds of phosphate-headed lipids sitting on their tails.

Similarities between membrane molecules and detergents also help to explain why the latter can pull greasy stains away from your clothing even though oils don’t dissolve easily in water. When tossed into a washtub, the negatively charged phosphate heads cling to the positive ends of the water molecules, and this attraction pulls the detergent into solution. The tails trail along behind until they meet fellow lipids in a dirty piece of clothing. When that happens, a tug-of-war ensues until swirling currents tear the detergents away by the roots along with clumps of crud.

Before the phosphate ban, a rinse cycle might flush your soapy wash water directly into a river where some lucky alga could snatch it up for the sake of those valuable phosphate heads. Scale this up large enough, add other phosphate sources such as municipal sewage, fertilizers, or eroding sediments, and you get the multicolored travesties of the Baltic Sea, the Gulf of Mexico, and Upper Klamath Lake. Phosphorus also makes the cells in your own body flourish just as it does the plankton in a body of water, and for similar reasons.

What are your ten trillion trillion phosphorus atoms doing inside you right now? Most of them are supporting the calcium phosphate frameworks of your skeleton, and most of the remainder are trembling in your cell membranes from head to toe. They are often removed from the outermost layer of your skin, however, shortly before the dead cells in it flake away and are lost to your surroundings. Those rescued atoms are shunted inward for use in the tissues beneath them, presumably because phosphorus is too precious to waste in the daily shedding of skin flakes.

Phosphorus atoms are also hard at work deeper inside your cells. Each cell contains a nucleus packed with DNA, all of it laced with phosphorus. These threads are usually too slender to see under a normal microscope, but if you were to fuse the DNA from all of your trillions of cells into one long strand it would stretch far beyond the orbit of

Pluto. Each strand twists around a matching strand, forming the famous double helix with weak hydrogen bonds bridging the gap between strands. Yet despite the vast amounts of genetic information that it encodes, your DNA consists of only four kinds of phosphorus-bearing building blocks, called nucleotides.

To read your genetic code, enzymes unravel your DNA to expose the nucleotides before reading them off in ticker-tape fashion, and here is another point at which phosphates become especially useful to you. The strong bonds that form between phosphates stabilize the main frameworks of DNA while the weaker bonds between the strands open and close like a zipper. Without those sturdy phosphate backbones, your genes would be too fragile to read.

One of the nucleotides, called adenosine triphosphate, or ATP, also works in isolation as well as in genes. Its main job in that case is to serve as a chemical battery for the cells that, among other things, move your limbs and tell you what the world looks, feels, and tastes like. The magic of an ATP molecule is in the triple string of phosphates that it carries. Pop the outermost phosphate loose, and a tiny burst of energy is released in a manner that allows work to be performed. Pop it back on and you can carry the re-energized bond anywhere in the cell until it is needed to prime a membrane pump, build a hormone molecule, or perform other services that your cells require.

Huge amounts of work go into running your body, and you break so many ATP molecules simply by breathing, thinking, and pumping blood that a pile of their discarded remains from a single day's activities could weigh roughly as much as you do. It's a good thing that you recycle them so quickly that you need only a few ounces of ATP in your body at any given time. Otherwise Liebig's law might have killed you long ago for lack of sufficient phosphorus. Your mitochondria do most of that recycling for you, harnessing energy from your food to bind that crucial third phosphate back into place on its ATP perch. You breathe oxygen primarily in order to power your ATP factories, and the ATP from those factories powers your breathing.

Other, more numerous elements of life are also important to you: Your body, after all, is mainly a watery bag of hydrogen and oxygen. But your phosphorus is especially valuable because it is often more difficult to obtain. Virtually every membrane-bound, energy-producing cell shares a similar need for this critical element, making it a universal bond between you and the rest of life on Earth.

Exactly where do your phosphorus atoms come from, and how long will those supplies last with billions of us sharing the planet? Of all the atoms of life, phosphorus may be the one most likely to limit the number of humans that can exist on Earth at any given time, although experts disagree over what our most limiting resources will be or exactly when and how they might force global population to level off.

We hear much about "peak oil," for example. Coal, oil, and natural gas were built by plants and plankton over millions of years, and when we burn them we scatter their atoms to the winds along with the energy that held them together. We won't ever run

out of their component atoms altogether: carbon and hydrogen are simply too numerous. But we could easily run out of cheap fossil hydrocarbon molecules within a century or so because we use them so much faster than they form.

In theory crop plants or algae can spin more hydrocarbons from air and water to replace what we burn, although cost, logistics, and ethics can complicate efforts to grow such biofuels on a scale large enough to satisfy our needs. Ultimately, however, it is the sheer numbers of atoms available for life that fix the boundaries beyond which Earth-bound populations cannot expand, regardless of our technologies and the resilience of our societies.

To put it most simply, we don't make the atoms that sustain our bodies but merely borrow them from our surroundings. What, then, are our purely atomic limits to growth? If we can estimate those, then we can at least define the outermost horizons of possibility to better anticipate the future of humankind.

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Krakauer, David Editor. Worlds Hidden in Plain Sight: The Evolving Idea of Complexity at the Santa Fe Institute 1984–2019 (p. 373-376). SFI Press. Kindle Edition.

From WORLDS HIDDEN IN PLAIN SIGHT Santa Fe Institute book
David Krakauer chapter Emergent Engineering

The Properties of Complex Systems

1. We have few general design principles for adaptive components (cells, organisms, nations) in isolation or in the aggregate where new unforeseen properties emerge.
2. Components typically have high failure rates in all tasks and accomplish their objectives through statistical averaging and approximation across multiple scales and levels.
3. There is significant uncertainty and lack of information at both the component and aggregate level, and components have large—and often poorly understood—repertoires of behavior.
4. Most evolved complex systems operate in nonlinear and often near-critical regimes (close to thresholds and tipping points).
5. Adaptability of components is the rule—not the exception—and learning and adaptation are ongoing and irrepressible.

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The Objectives of an Emergent Engineering

1. Seek to modify the reward or selective context in which semiautonomous agents operate and design toward better incentives.
2. Accept significant component error rates and focus on mechanisms that can average and aggregate these effects to acceptable levels in the collective output.
3. Design with an eye towards distributions of outcomes and not towards deltas (single optimal outcomes), pursuing average properties throughout.

4. Develop mechanisms for controlling nonlinear dynamics and predicting and influencing critical transitions.
5. Harness adaptation to allow for continued exploration and exploitation rather than coercing systems into single states that require endless iterations of costly novel production.

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Perhaps the greatest “phase transition” in our thinking that such an approach could engender is the maturation in our willingness to live with relatively high levels of uncertainty in the domains of complex phenomena—and thus give up on ideas like complete “cures,” the elimination of “risk,” the design of perfect “stability,” and achieving total “security.” We replace these ideals of a deterministic age with an understanding of the ever-evolving nature of adaptive processes, seeking to discover new methods for the specification of incentives, rewards, constraints, and communication, together capable of moving outcomes into a space of desirable, albeit never optimal, performance.

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From THE ZOOMABLE UNIVERSE by Caleb Scharf

We dig into this world with our hands, and mine it with our tools. We mold its substances into forms that we need, or simply want. **Like all living things, we are constantly converting one set of compounds into another, in the air we breathe, the food we eat, and the fuels we burn.** Billion-year-old bedrock becomes building material for a home, a school, or a statue. Seams of naturally concentrated metals become our bridges, cars, bicycles, wedding rings, and circuit boards. Refined ores become fuel for nuclear reactors; arduously extracted rare-earth elements help guide electrons and enhance magnets in computers and smartphones.

We’ve become expert at this scavenging—too expert for our own good. We’ve drastically altered the balance of the Earth, and as a consequence now exert enormous pressure on organisms and environments that are part of the very system that supports us.

Of course, we’re not the first species to mess around with the global environment. About two and a half billion years ago, species of microbial life began to dump their waste product, oxygen, into the atmosphere. That chemical pollution signaled a profound shift in the chemical and climatological state of the planet, and in all the life that followed.

Those early photosynthesizing oxygen producers had little choice in the matter—they were simply deploying the metabolic tools that emerged from their evolution. We humans are distinct, and interesting, because we are aware of what we’re doing and usually have some sense of the consequences of our actions.

By the same measure, while Earth is our birthplace and playpen, it’s also completely indifferent to us. There is no special reason why Earth is “just right” for us. After all, we

came from it—not the other way around. Whatever we do to the Earth, and whatever we do to life here, the planet will carry on and evolution will keep unfolding, **relegating our era to a thin band in some future sedimentary rock.**

That's because (like any planet) Earth is a powerful thermodynamic, chemical, and radiological machine. Multitudes of phenomena are knit into the planetary surface and interior, as well as woven through time. Properties that we take for granted, from climate to fossil fuels, are the consequence of deep cycles and serendipitous events scattered across billions of years. In truth, all that we relish about Earth is one sentence of a much larger story.

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From the book THE VALUE OF NOTHING HOW TO RESHAPE MARKET SOCIETY AND REDEFINE DEMOCRACY by Raj Patel

“the most satisfying answer is that, in fact, there is a countermovement—indeed, there are many countermovements, progressive and reactionary, inclusive and exclusive. It's just not widely reported, as, especially in the case of progressive examples, **the people leading such movements are the poor, the dispossessed, the marginalized, the people on whose shoulders the externalities of the rich often fall**, the world's least free people who are discovering that they are The Change They've Been Waiting For. In the next part, **we'll look at how, exactly, they've tried to rebalance market society and how they're trying to transform the way value is set, not by returning to the commons, but by reinventing it.**

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Article online chemicals and phosphorus

A Bottleneck in Nature <https://www.backyardnature.net/phosphor.htm>

In fact, *all life needs these minerals*. Life simply doesn't happen without them. We're not just speaking of calcium, potassium and magnesium.. The last time I looked, these mineral elements were all absolutely required for *plants* to stay alive: **nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, boron, chlorine, iron, manganese, zinc, copper, molybdenum, and nickel.**

For example, at the heart of *every* molecule of chlorophyll, there is an atom of magnesium, so without magnesium photosynthesis is impossible, and without photosynthesis green plants and higher animals that eat the plants can't exist. Every protein molecule has an atom of nitrogen in it and you know that there can't be muscles and many other things without protein. There can't be red blood cells without the iron in hemoglobin molecules... On and on it goes with each required mineral element.

Once it sinks in that these mineral elements are really *needed* for life -- not like "I need a hamburger with pickles" but like "I need air" -- then this question arises:

Which of the above mineral elements do organisms stand the greatest chance of running out of?

The answer is: **Phosphorus.**

In fact, Isaac Asimov, an important science writer, has defined **phosphorus as "life's bottleneck."** This is true even though phosphorus is by no means the rarest mineral element. If you have a miniscule amount of something but only need a tiny, tiny bit of it, then that's less critical than if you have a fair amount of something, but you need a lot of it.

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From the book LOONSHOTS by Safi Bahcall

Neither efficient markets nor invisible hands are fundamental laws. They are both emergent properties.

Emergent properties are collective behaviors: dynamics of the whole that don't depend on the details of the parts, the macro that rises above the micro.

Molecules will flow at high temperatures and freeze at low temperatures regardless of the differences in their details. A water molecule has three atoms and is shaped like a triangle. Ammonia has four atoms and is shaped like a pyramid. Molecules of buckminsterfullerene have sixty atoms and are shaped like soccer balls (they're called buckyballs for short). Yet they all exhibit the same fluid dynamics at high temperatures and solid dynamics at low temperatures.

One of the things that distinguishes an emergent property like the flow of liquids from a fundamental law—like quantum mechanics or gravity, for example—is that an emergent property can suddenly change. With a small shift in temperature, liquids suddenly change into solids. **That sudden shift from one emergent behavior to another is exactly what we mean by a phase transition.**

Although all people are different, and all teams are different, what makes emergent properties and the phase transitions between them so interesting is that they are so predictable. We will see why organizations will always transform above a certain size, just like water will always freeze below a certain temperature, traffic will always jam above a critical density of cars, and one burning tree in a forest will always explode into a wildfire in high winds. These are all examples of phase transitions.

Each person and team may be a puzzle. But in the aggregate, as Sherlock Holmes might say, the likelihood that any group will experience a phase transition becomes a mathematical certainty.

The terrific thing about the science of emergence is that **once we understand a phase transition, we can begin to manage it.** We can design stronger materials, build better highways, create safer forests—and engineer more innovative teams and companies.

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emergent behavior—

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The percolation models predict something you would never guess through intuition, or experience, or microsimulations with different tree types and vegetation. It is a unique prediction of the science of emergence and of phase transitions. According to these models, as a forest gets dangerously close to a phase transition, to erupting, the frequency of fires should take a specific form. The frequency should vary in inverse proportion to size: Twenty-acre fires should occur half as often as ten-acre fires. Forty-acre fires should occur one-quarter as often as ten-acre fires. Hundred-acre fires should occur one-tenth as often, and so on.

That pattern, called a power law, is a surprising prediction—a mathematical clue that a forest is on the verge of erupting. The pattern has been seen elsewhere. As we will discuss below, **the power-law pattern** is seen not only in forest-fire models, but in financial markets and terrorist attacks.

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Vaclav Smil POWER DENSITIES BOOK

What It Would Take

If you are willing to engage in unbounded science and engineering fiction, then, according to Jacobson and Delucchi (2011), this is what it would take to supply the world with 100% renewable energy in 2030 by using electricity (generated by wind, water, and solar PV installations) and electrolytic hydrogen for all purposes: 3.8 million 5-MW wind turbines, 49,000 300-MW central solar plants, 40,000 300-MW solar PV plants, 1.7 billion 3-kW rooftop PV installations, 5,350 100-MW geothermal plants, 270 new 1.3-GW hydro stations, 720,000 0.75-MW wave devices, and 490,000 1-MW tidal turbines. All of that would require only about 0.4% of the world's land for its footprint and 0.6% for spacing, and we are assured that the "barriers to the plan are primarily social and political, not technological or economic" as the energy cost in a new wind-water-solar world "should be similar to that today."

These assurances asides, the simplest reality check shows the fictional nature of these assumptions. In 2013 the worldwide capacity in wind turbines reached about 330 GW, while 13 TW (40 times as much) would be needed by 2030. Total rooftop and large plant PV capacity reached about 100 GW, but 17.1 TW of these installations would be required (170 times as much); moreover, there was not a single 300-MW solar PV plant (five plants rated between 200 and 250 MW), whereas 40,000 would be needed by 2030. In 2013 there was only one central solar power facility rated at more than 300 MW, Ivanpah, at 392 MW, but nearly 50,000 such facilities would be needed by 2030

(an increase of four orders of magnitude). There were fewer than 50 geothermal stations rated at more than 100 MW, but 5,350 would be needed (a 100-fold increase). Pelamis (2014, the world's most advanced wave energy company, produced six 0.75-MW devices by the beginning of 2014, but 720,000 would have to be operating by 2030 (an increase of five orders of magnitude). Finally, by 2013 there were fewer than ten small tidal stations with aggregate installed power of much less than 1 GW, while 490 GW would have to generate by 2030 (two orders of magnitude more).

Such a ramping-up of all kinds of capacities-design, permitting, financing, engineering, construction, all going up between one and five orders of magnitude in less than two decades-is far, far beyond anything that has been witnessed in more than a century of developing modern energy systems.. And that still leaves out two other key facts, namely, that such a gargantuan renewable energy system would need an enormous expansion of high-voltage transmission and would require the creation of an entirely new, hydrogen-based society. I still am not sure how we would fly with hydrogen (or electricity) or smelt pig iron. In any case, the chances of a 100% water-wind-solar world to be ready by 2030 are nil, but it is worth while exploring what it would (realistically) take to create an increasingly nonfossil global energy system.

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End of book:

Energy studies have accomplished a remarkable feat by largely ignoring space as a key organizing determinant of modern systems supplying fuels and electricity.

But space matters: resources occur in specific locations and configurations, and their harnessing, conversion, and use proceed with power densities whose values are fundamentally limited by environmental constants and circumscribed by advancing technical capabilities. *Modern civilization has evolved as a direct expression of the high power densities of fossil fuel extraction, but that extraction is predestined to claim only a short time span of human evolution.* **New energy arrangements are both inevitable and desirable, but without any doubt, if they are to be based on large-scale conversions of renewable energy sources, then the societies dominated by megacities and concentrated industrial production will require a profound spatial restructuring of the existing energy system, a process with many major environmental and socioeconomic consequences.**

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THE MOVEMENT WE NEED Andreas Malm: Revolutionary Strategy in a Warming World Posted on March 17, 2018 in Books

Precisely the abysmal divides within the species — belying the talk of the ‘Anthropocene,’ of humanity in general as responsible, of ‘us all’ as the enemy — may prove the greatest obstacle to attacking the causes of catastrophe: the victims of the systematic violence known as fossil fuel combustion may simply be too far away from the perpetrators to topple them. ‘Revolutions-as-symptoms’ target exploiters and oppressors in the immediate vicinity and so are not hard to imagine when some lives become unbearable, but ‘revolutions-against-the-causes’

must, if they are to be launched by the classes most concerned, travel across the globe. Uprisings then seem likely to continue targeting nearby Makhloufs rather than faraway Tillersons. Put differently, **the spontaneous formation of trade-union consciousness in a warming world — a basic prerequisite for any kind of October thrust — looks like a very uncertain prospect.** It is otherwise with, for instance, oil exploration — when a corporation intrudes on a people’s ancestral homeland to drill for the fuel, the antagonism is in your face and resistance comes naturally — but **global warming as such can slaughter millions from within a castle never seen and, alas, hard to raid.**

This appears to be the fundamental strategic conundrum for the struggle against climate change. The most promising vision for breaking out of it has been formulated (although not in such terms) by Naomi Klein in *This Changes Everything: Capitalism vs. the Climate*. **Short-circuiting the distance problem, she argues that, since present-day capitalism is so saturated with fossil energy, more or less everyone involved in some social movement under its rule is objectively fighting global warming, whether or not she or he cares about it or suffers its consequences.** Brazilians protesting fare hikes and demanding free public transit all but raise the banner of the fifth measure in the list above, while the Ogoni people kicking out Shell are busy working on the first.[63] Similarly, European auto-workers fighting for their jobs, in accordance with the kind of trade-union consciousness they have always possessed, have an interest in converting their factories to the production of technologies required for the transition away from fossil fuels — wind turbines, buses — rather than seeing them disappear to some low-wage destination.[64] **All struggles are struggles against fossil capital: the subjects only need to be made aware of it.** In Klein’s words, ‘the environmental crisis — if conceived sufficiently broadly — neither trumps nor distracts from our most pressing political and economic causes: it supercharges each one of them with existential urgency.’[65] This formula has the added appeal of making the broadest possible alliance conceivable. Clearly, nothing less will be needed in this struggle.

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THE EARTH AROUND US: MAINTAINING A LIVEABLE PLANET Jill Schneidman Editor

The point seems to be that we humans are now a geological force of global proportions, creating and running an experiment *for which we have little predictive certainty.*

Well, there you have it. Here is what my neighbor ought to know about how Earth works. The population is growing rapidly and becoming urbanized at an unprecedented scale. ***As a whole, we seem to misunderstand the lessons of the laws of thermodynamics—the set of rules governing how energy and matter behave. We cannot make things out of nothing. We cannot throw things away, and it is very***

hard to clean up messes. We have grown so numerous and so powerful that we are now a geological force of global proportions. We regularly disturb major biogeochemical cycles. Every human being needs to appreciate these three profound ideas. With a future that is environmentally precarious, ignorance of these ideas is just too expensive—its cost could be the livability of our planet.

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LIVING OIL by Stephanie LeManager

Why is oil so bad? 1.) Because it has supported overlapping media environments to which there is no apparent “outside” that might be materialized through imagination and affect as palpable hope.

Sinclair’s *Oil!* is a type of peak oil fiction, since it was written as a warning against global petromodernity from around the moment of peak oil discovery in the United States—again, the late 1920s. The novel strives to imagine curtailing petromodern development in a manner complementary to the fictional post-petrol futures offered by twenty-first-century peak oilers. In both cases, imaginative thinkers struggle to break out of media environments already sustained by petroleum infrastructure. Cut to a scene rather late in *Oil!*, when Sinclair’s radical hero, Paul Watkins, lies dying in a Los Angeles hospital. The reader has been directed to feel outrage over Watkins’s injury. He was beaten at an Industrial Workers of the World rally by Red-baiting so-called patriots. As Watkins loses consciousness, Sinclair, in a rare nod to modernist technique, intercuts the absurdly pleasant song playing on a neighbor’s radio with his manifest plot. The controlling voice of the novel, at this point an earnest socialist youth, is silenced by popular lyrics: “What do I do?/I toodle-doodle-doo,/I toodle-doodle-doodle, doodle-doo!” Given that Sinclair was not a playful prose stylist, this rare instance of heteroglossic frisson points archly to the manner in which the comic potential of a modern consumer culture already founded on cheap energy challenges the intention of “doing”—as in acting in a manner truly counter to petrocapi-talism.

The novel itself is a media environment that refers to (and is referred by) other media environments supported by petroleum, from the fictional auto dealerships that Sinclair tells us sponsor the fictional neighbor’s radio broadcast to the petroleum involved in the manufacture and transport of the novel. In the late 1920s, commercial book manufacturers might have relied on coal-generated electricity, perhaps even older steam or hydropower technologies. One could still find commercial presses operated by treadles, like *Kunstler’s* vintage dental drill. These probably would be printing small-town newspapers. ¹⁶ However, it is likely that petroleum-based fuel was used in the transportation of Sinclair’s book, even in the late 1920s.

The total distance for book shipment then could not have approached the average 1.25 billion miles that books travel today, primarily in trucks and container ships. The 2007 edition of *Oil!* that I refer to here is heavily indebted to petroleum. A mixture of petroleum-based resins and oils make up the ink that creates the words on the page of

my edition of Oil!, words that direct my imagination and activate my senses. I literally enter an immersive, virtual environment through petroleum language. Petroleum in the form of diesel fuel supports my book's travel, and the travel of its component parts, namely its paper. Then there are the electricity, fuel oil, and natural gas required to keep press equipment running, to heat and light buildings that house the equipment. The book occupies many sites, some of which exist solely for it, such as its place of manufacture, storage warehouses, retail stores, libraries, private homes. Ultimately my edition of Oil!—well, not mine, but one like it, could be thrown away and driven to a landfill. Imagine, then, more diesel. 17 To step outside of petromodernity would require a step outside of media, including the modern printed book. What does that act like?

The inescapability of petroleum infrastructures has entered fiction as both dystopian and utopian space. These spatial imaginaries were of particular literary interest in the 1950s and early 1960s, when petromodernity reached its classic form within the U.S.-built environment and—not coincidentally—North American media theory began to develop under the influence of Marshall McLuhan. In both petrodystopias and petro-utopias, spatial representation defies realism insofar as space appears closed to history, to changes over time. There are few if any temporal paths out of the conceptually whole ou-topos of perfection and disaster. For Ray Bradbury, writing in the 1950s in Los Angeles, which I conceive as the “it” city of twentieth-century petromodernity, the saturation of human life by petromedia in *Fahrenheit 451* (1950) takes the form of a city soaked in kerosene, which is a highly flammable distillation of crude oil. The smell of kerosene pervades the novel, as do the results of its work—namely the burning of books and, metonymically, the end of critical thinking. Here we have an exploration of oil infrastructure as a mode of censorship, inflecting people's most intimate lives.

Bradbury's alarm about the domination of wraparound media such as television sounds today a bit shortsighted and panicky, a pop version of the philosophical indictments of mass culture's complementarity to fascism associated with Theodor Adorno and Max Horkheimer. What I find interesting about Bradbury is the explicit connection he makes between the totalitarian thought police, the “firemen,” and fossil fuel. “Kerosene . . . is nothing but perfume to me,” the conflicted fireman Guy Montag quips at the start of the novel. 18 As *Fahrenheit 451* draws to a conclusion, Montag has fallen in love with books and has been forced to watch his own small collection “leap and dance like roasted birds, their wings ablaze with red and yellow feathers.” 19 The dream of fire voiced by the novel's evil fire chief, Beatty, as “the thing man wanted to invent but never did . . . perpetual motion,” 20 reverberates throughout the novel in (petrol-fueled) automobiles on (petroleum-based) asphalt streets and in the perpetual flicker of television, screening (through predominantly natural gas-fueled electricity) the fictive city's denizens from the world resource war [time to stop here. enough for the idea and soaked in oil]

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From LOONSHOTS by Safi Bahill

I'll describe the science briefly (skipping the boring stuff). And then we'll see how small changes in structure, rather than culture, can transform the behavior of groups, **the same way a small change in temperature can transform rigid ice to flowing water.** Which will give all of us the tools to become the initiators, not the victims, of innovative surprise.

Along the way, you will learn how chickens saved millions of lives, what James Bond and Lipitor have in common, and where Isaac Newton and Steve Jobs got their ideas.

I've always appreciated authors who explain their points simply, right up front.

So here's the argument in brief:

1. The most important breakthroughs come from loonshots, widely dismissed ideas whose champions are often written off as crazy.
2. Large groups of people are needed to translate those breakthroughs into technologies that win wars, products that save lives, or strategies that change industries.
3. Applying the science of phase transitions to the behavior of teams, companies, or any group with a mission provides practical rules for nurturing loonshots faster and better.

In thinking about the behavior of large groups of people in this way, we are joining a growing movement in science. Over the past decade, researchers have been applying the tools and techniques of phase transitions to understand how birds flock, fish swim, brains work, people vote, criminals behave, ideas spread, diseases erupt, and ecosystems collapse. If twentieth-century science was shaped by the search for fundamental laws, like quantum mechanics and gravity, the twenty-first will be shaped by this new kind of science.

None of which..

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Haraway Tsing Edge Effects talk April 2019

REFLECTIONS ON THE PLANTIOCENE

<https://edgeeffects.net/haraway-tsing-plantationocene/>

“Tsing

I think we don't have any choices except to try to do our best to live with others and go forward. I think we need all kinds of storytelling and appreciation, from science through every other genre we can think of, in order to do that. I will also say that because one of the responses to my book on mushrooms was, oh,

everything's going to work out just fine because you're so optimistic, that really turned me towards the Plantationocene to say, I don't think that's true. We can't just sit back and think everything's going to work out. Part of what going forward means to me is telling some really terrible stories about what's going on in the world. I feel that humanists and social scientists have lost track of how to do that. We're so busy generating stories of hope sometimes, and I'm implicating myself too, that **we have to relearn some of the arts of storytelling for telling terrible things that we need to know about. These are necessary for our ability to work well with others.**"

"Haraway

I think that we need to cultivate the practices of keeping heart, of giving each other the capacity to get up in the morning with a certain capacity for play and joy. This is not simple, and it takes many kinds of sensibilities, particularly in times of accelerating crisis and mass extinction and many other things. For me, part of what helps is a firm conviction that we really do need one another's sensibilities here, including ones which insist, not so fast with your happy story, lady. We really need each other's sensibilities to collect up the range of skill and affect and commitment that will enable us to live in a thick present. I don't so much have hope as what I call heart, because I try to cultivate a way of thinking that is not futurist but rather thinks of the present as a thick, complex tangle of times and places in which cultivating response-abilities, capacities to respond, matters.

I was instructed in this by Deborah Bird Rose and her work with Australian Aboriginal teachers from the Yarralin community in the Northern Territory of Australia. Her teachers talked to her about how a serious adult person takes care of country—the Anglo translation of that extraordinary complex of ancestors, living beings both human and more than human, landscapes, and more that constitute country. Contemporary living people are responsible for taking care of country, which means facing those who came before so as to leave to those who come after less wild, less blasted country. You don't look forward toward those who come next. Mind you, the people who are telling Deborah Bird Rose this have experienced the elimination of approximately 80 to 90% of their own genealogical lines and dream lines and tracks. These are people who have been subjected to the end of the world in an extremely radical way, who are talking to her about continuing to take care of country and to continue to care for the lines that still exist as well as being somewhat open to building in new dream tracks and new lines in country, to make kin in new and old ways. There's a complex set of relationships here.

But this kind of present—the Anglophone word for the time of being serious about taking care of country—is about a hundred years in duration. It's the time of the possibility of telling stories about named beings, people whose names you remember or somebody remembers, or an animal you encountered. **The storytelling has the quality of a life story, that's the present. The present is about a hundred years, not instantaneous but thick.**

I like that way of thinking about how we somehow cobble together the capacity to do the kind of repairing that can be done, to block that kind of onrushing damage that can be blocked, to affirm mortality and to refuse various kinds of techno-optimism or techno-pessimism and to truly refuse transcendence in all its forms, which involves a kind of understanding that there will be no status quo ante. There will be no going back to some fully repaired place. That is not the same thing as saying there can be no repair, restoration, restitution, cobbling together again, and including new stuff, beings who are coming into the world, ways of living in the world that haven't been on this planet before.

I think every single time critters play with each other, a couple of dogs, for example, they're using their inherited repertoire. They're choreographing in a biologically pre-saturated way, and in any play bout worth the name of play, they take that inherited set of capacities and they do something with it that has quite literally never happened on this planet before. Play is exactly that. It is that taking up of inheritance in choreographies and interactions that produce what has truly never been on this planet before. Play is sustained by joy. Nobody is going to stay in a play bout unless it's sustained by joy. For one thing, it's too dangerous. Play is never safe. There's something about that that feels to me really fundamental to being an organism
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INFINITE POWERS; HOW CALCULUS REVEALS THE SECRETS OF THE UNIVERSE by Steven Strogatz

“In any case, it's a mysterious and marvelous fact that our universe obeys laws of nature that always turn out to be expressible in the language of calculus as sentences called differential equations. Such equations describe the difference between something right now and the same thing an instant later or between something right here and the same thing infinitesimally close by. **The details differ depending on what part of nature we're talking about, but the structure of the laws is always the same. To put this awesome assertion another way, there seems to be something like a code to the universe, an operating system that animates everything from moment to moment and place to place. Calculus taps into this order and expresses it.**

Isaac Newton was the first to glimpse this secret of the universe. He found that the orbits of the planets, the rhythm of the tides, and the trajectories of cannonballs could all be described, explained, and predicted by a small set of differential equations. Today we call them Newton's laws of motion and gravity. **Ever since Newton, we have found that the same pattern holds whenever we uncover a new part of the universe. From the old elements of earth, air, fire, and water to the latest in electrons, quarks, black holes, and superstrings, every inanimate thing in the universe bends to the rule of differential equations.** I bet this is what Feynman

meant when he said that calculus is the language God talks. If anything deserves to be called the secret of the universe, calculus is it.”

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“Calculus, like other forms of mathematics, is much more than a language; it’s also an incredibly powerful system of reasoning. It lets us transform one equation into another by performing various symbolic operations on them, operations subject to certain rules. Those rules are deeply rooted in logic, so even though it might seem like we’re just shuffling symbols around, we’re actually constructing long chains of logical inference. The symbol shuffling is useful shorthand, a convenient way to build arguments too intricate to hold in our heads. If we’re lucky and skillful enough—if we transform the equations in just the right way—we can get them to reveal their hidden implications. To a mathematician, the process feels almost palpable. It’s as if we’re manipulating the equations, massaging them, trying to relax them enough so that they’ll spill their secrets. We want them to open up and talk to us. Creativity is required, because it often isn’t clear which manipulations to perform”

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Book YOUR ATOMIC SELF by Curt Stager

"The tremendous velocities of free-floating molecules and atoms make them smash rapidly and repeatedly into their equally energetic neighbors. **At room temperature and at sea level, an oxygen molecule collides with its atmospheric companions more than a billion times per second**, and if you could hold your hand perfectly still for a single second in what appears to be motionless air, it would nonetheless be **pummeled by more than** a trillion trillion such impacts. The seemingly empty spaces around you are so full of careening molecules that, if you could clearly see them in their multitudes, it might make you queasy to inhale or walk through them.”

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After Extinction Richard Crusin Editor Joseph Masco 6 Extinctions Essay

“How to see everyday activities—eating, transportation, water use, and energy use, as well as national security—as a planetary force is an immediate challenge today. After all, industrial civilization has been largely devoted to creating and expanding creature comforts as the very index of progress since the European Enlightenment. Consumer pleasure is, therefore, at the heart of climate change, requiring not only the complex analytics of the IPCC but also understandings of the historical production of psyches, cultures, desires, and even nervous systems.”

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BEING THE CHANGE Peter Kalmus

“Those of us who were born into industrial society entered a powerful system that determines our beliefs and daily actions. Socialization colors how we see the world and makes it difficult, maybe even impossible, to see objectively.

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Rachel Maddox New Yorker Article 2017
PROFILES OCTOBER 9, 2017 ISSUE

“Maddox said. “I think I am a liberal. I believe that government is a manifestation of the social contract. It’s a way we ought to work together as our best selves to make things better for the least among us and improve society as a whole.”

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DEEP TIME DC Museum Exhibition National Academy of Science
Written by JD Talas Ek is the director of Cultural Programs of the national academy of sciences. he has curated a number of shows that explore the intersection between science and art.

Conclusion

The work of artists presented in this exhibition does not present evidence but **rather raises the question of the possibilities of art’s power to promote a deep awareness of the natural world that science reveals.** in a 2010 interview with biologist E.o.Wilson for the online symposium *Visual Culture and Evolution*, Wilson presents a challenge for both artists and scientists. he states that scientists often fail at conveying the sense of awe and wonder of the natural world that is the driving force behind scientific inquiry. he also states that artists have the ability to inspire us but that they often get the science wrong. informed artwork carries more authority and strengthens its ability to significantly enter into a larger cross-disciplinary dialogue.[18] this exhibition focuses on the topic of *imagining* deep time, but Wilson’s challenge still resonates throughout the artwork. as stated previously, comprehending deep time is a convergence of the rational and the intuitive. mining scientific evidence alongside informed intuition makes the terrain between science and art a fruitful area for investigation. Art and science overlap in significant ways. The act of discovery and creativity is the same mental process in both despite the epistemological motivation or outcome. the difference manifests itself in the way work is actualized – either in the form of scientific research or artistic exploration. that current lines separating art and science are blurring suggests that perhaps new ways of network- ing knowledge to solve problems and inform one another are needed. for the artist, like the scientist, observation is fundamental in the act of discovery and art making is a cognitive tool for making sense of that discovery on a personal level. Working in the space between disciplines reaches its highest potential when the lines of thinking are blurred to form a new more deeply informed perspective. a new perspective may be a personal “eureka” moment. but it also has the potential to prompt a larger shift in societal thinking that acknowledges our collective impact on the trajectory of future time on a large scale. the vast- ness of the earth’s age is an alien experience to us. but the perspective of science and art combined provides a portal through which our imagination can flourish as we consider the wonders of the past and contemplate the future.”

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Kari Marie Norgaard. Living in Denial: Climate Change, Emotions, and Everyday Life (Kindle Locations 2491-2493). Kindle Edition.

LIVING IN DENIAL by Kari Marie Norgaard

“In this chapter, however, I explore how even or perhaps especially in the United States these more overt forms of skepticism (again, what Stanley Cohen [2001] calls "literal denial") have overshadowed another larger and more insidious phenomenon—**the way a majority of the public is concerned but has normalized their knowledge rather than acting on it.**”

Kari Marie Norgaard. Living in Denial: Climate Change, Emotions, and Everyday Life (Kindle Locations 3340-3345). Kindle Edition.

“..see the work of Cynthia Frantz and Stephan Mayer (2009), who apply a social psychological model of helping behavior to human response to climate change. Using this model, the authors identify five conditions that must be present in order for helping to occur. One of these conditions is that the potential helper must identify the event as an emergency situation. The authors note that the ambiguity of emergency situations may prevent people from responding and that people don't want to feel foolish by "overreacting." Individuals often navigate ambiguities by relying on the interpretations of others for their judgment of what is an emergency. The obvious application **regarding denial of climate change** is that **because individuals often cannot see it directly, and because those around them are not reacting, they may not define it as an emergency.**>

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CARBON by KATE Ervine

“Indeed, patient, critical analysis **requires that we connect the dots** when considering proposed solutions to the problem of carbon—who benefits and who pays, what is enabled and what might be blocked.”

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LEARNING CAUSALITY IN A COMPLEX WORLD By Tina Grotzer

“The familiar phrases here are 21st century skills and 21st century learning. Around the world, several frameworks have emerged toward a formal education that speaks more powerfully to the lives today’s learners are likely to live. **Global understandings, learning to learn, self-management, entrepreneurship, critical and creative thinking, collaboration, facility with information technologies, and many other areas take a place alongside a call for deeper learning in the disciplines.** The trend is heartening, and the present exploration of complex causality contributes to it.

However, Learning Causality in a Complex World becomes especially important for its insight and out-sight because these ambitious initiatives seem to have missed complex causal thinking.”

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[copy paste not available]

Chap ** Spatial gaps. Action at a distance are more difficult to grasp

Chap **

Attentional capture, causal mechanisms, nonvisibility can lead to denial of risk.
Nonobvious causes can be harder to think about.

“Another way to help students reason about non-obvious effects is to find ways to make them obvious.”

From Learning Causality in a Complex World by Tina Grotzer. Blue Reader copy

Table of Contents. [A good summary of concepts]

Preface xi David Perkins 1

Introduction 1

Part 1: The Lure of Simple Causality 17

2 Simple Linear Causality: One Thing Makes Another Happen 19

3 The Cognitive Science of Simple Causality: Why Do We Get Stuck? 23

Part 2: Getting beyond Simple: A Set of Causal Patterns for the Curriculum 39

4 Domino Causality: Effects That Become Causality 41

5 Cyclic Causality: Loops and Feedback 49

6 Spiraling Causality: Escalation and De-escalation 55

7 Mutual Causality: Symbiosis and Bi-directionality 61

8 Relational Causality: Balances and Differentials 67

Part 3: Features of Complex Causality and Our Related Default Assumptions 73

9 Across Time and Distance: Detecting Delayed and Distant Effects 75

10 “ What Happened? ” vs. “ What ’ s Going On? ” : Thinking about Steady States 87

[there are 6 or 7 more. However i cannot get the copy paste to work. So there are two screen save copies in the Photo Library]. There it is below. Learned a new tool here.

Table of Contents

Acknowledgments

Preface

1 Introduction

Part 1: The Lure of Simple Causality

2 Simple Linear Causality: One Thing Makes Another Happen

3 The Cognitive Science of Simple Causality: Why Do We Get Stuck?

Part 2: Getting beyond Simple: A Set of Causal Patterns for the Curriculum

4 Domino Causality: Effects That Become Causality

5 Cyclic Causality: Loops and Feedback

6 Spiraling Causality: Escalation and De-escalation

7 Mutual Causality: Symbiosis and Bi-directionality

8 Relational Causality: Balances and Differentials

Part 3: Features of Complex Causality and Our Related Default Assumptions

9 Across Time and Distance: Detecting Delayed and Distant Effects

10 "What Happened?" vs. "What's Going On?": Thinking about Steady States

11 What You Can't See Does Matter: Attending to Obvious and Non-obvious Causes

12 It's Not Always a Case of "Who Did It?": Minding Passive and Unintentional Causality

13 Step by Step . . . or Not: The Mind-bending Concept of Simultaneous Causality

14 Figuring Out What to Count On: Dealing with Stochastic Causality

15 Isn't Anybody in Charge around Here?: Attending to Distributed Causality and Emer...

Part 4: Summing Up: The Implications for Helping a New Generation Understand Caus...

16 Putting It All Together: Teaching for Causal Complexity

References

Now Reading book on Circuits from this lab

Cyclic **Simultaneous** circuit. Electrons running in a circle.

Key thing is to think about simultaneous things, like setting up for the Kremer Prize, rather than thinking in linear one after another form .

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copied from book in blue reader

Each of these examples appears to have an obvious cause — one that we can perceive and conjure up a clear image of. It is a common human tendency to look for obvious causes and a sensible tendency at that. It often makes sense to first search for what you can see before you search beyond the limits of unaided perception. This is not to argue that we don't or can't search for **non-obvious causes**. There is compelling research reviewed below to suggest that even young children look for obvious causes first and, failing to find one, look for not-so-obvious causes. **1 However, if an obvious, possible cause is present, children generally will not search further whether or not it is the actual cause. Even adults do not seek a non-obvious or hidden cause when an obvious one exists.**

Many common phenomena are the outcome of imperceptible causes — ones that we can't perceive without special means to help us. Examples from the physical and biological worlds abound — from sunsets, soap bubbles, shapes of the clouds, patterns in our weather, the viruses that can make us sick, to the beneficial organisms that allow us to digest our food. The social domain is also full of non-obvious, inferred causes — motivations, intentions, beliefs, perceived slights, political moves, and so forth. We're actually not so hesitant to reason about social causes, but I'll come back to that in the next chapter. Visualize a rainbow. If you ask what causes a rainbow, people typically report background conditions — it has to be raining when the sun is out. Moving beyond background conditions is harder. The actual, physical cause is completely non-obvious. A rainbow is the result of thousands of tiny water droplets acting as prisms, dispersing the light into colors arranged by their frequencies. Different colors of light travel at different frequencies. These different frequencies move at different speeds in transparent materials, causing each to refract, or bend, at a different angle. This results in dispersion, or the separation of light into different colors. Sometimes, non-obvious causes are accompanied by non-obvious effects — at least at first. **Patterns of accumulation can behave this way. In its natural state, gas is odorless and colorless. Its existence would be completely non-obvious to an observer.**⁴

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GREAT TIDE RISING by Kathleen Dean Moore (excerpted from Review
<https://bookscansavealife.com/2018/05/16/great-tide-rising/>

*“It’s a... stunning thing that we face climatic changes that will undermine the lives of our children – and very few people are talking about it....most likely it’s a variety of what American intellectual Lewis Mumford called a ‘magnificent bribe.’ The bargain is that each member of the community may claim every material advantage, every intellectual and emotional stimulus he may desire, in quantities hardly available hitherto even for a restricted minority: **food, housing, swift transportation, instantaneous communication, medical care, entertainment, education**’ – on the condition, I would say, that they never ask where it came from, or at what cost in human suffering, at what cost to the future, or to what long-term effect. That’s the deal: If they ask, they have to turn away from their glittering lives.”*

(From Books Can Save A Life essay)

“Joanna Macy calls this The Great Turning. In Macy’s words:

“The Great Turning is a name for the essential adventure of our time: the shift from the industrial growth society to a life-sustaining civilization...A revolution is under way because people are realizing that our needs can be met without destroying our world....Future generations, if there is a livable world for them, will look back at the epochal transition we are making to a life-sustaining society. And they may well call this the time of the Great Turning. It is happening now.”

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For **Great Tide Rising**, Moore interviewed [Mary Evelyn Tucker](#), a professor at Yale Divinity School and the Yale School of Forestry and Environmental Studies, who spoke of the human instinct to create. Her words compose one of the most beautiful and hopeful passages in the book:

“Humans desire, more than anything else, to be creative, and we desire to participate in the creative processes, in the future and in life – that’s what having children is about. But we can be life-generating in a variety of ways – creative, participatory, oriented toward something larger than ourselves....

Our work is to align ourselves with evolutionary processes instead of standing in their way or derailing them. So our human role is to deepen our consciousness in resonance with the fourteen-billion-year creative event in which we find ourselves. Our challenge is to construct livable cities and to cultivate healthy foods in ways congruent with Earth’s patterns. We need the variety of ecological understanding so we can align ourselves with the creative forces of the universe. Something is changing; an era is changing. If we are shutting down the Cenozoic era...the great work is to imagine how the new era can unfold. Our work in the world is not just a stopgap to extinction....We are part of the Great Work, as Thomas Berry would say, of laying the foundation of a new cultural era.”

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“I didn’t ask them to give me **unnaturally cheap oil** by **externalizing** all the costs onto me and my children.”

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[Important/Aggregate]

“HAVING SAID ALL this, having laid the blame for the carbon catastrophe at the big feet of Big Oil, having insisted on the right to lay blame, I have to admit that none of us, you or I, get off the hook. The complication is that none of my individual acts—say I drive to the grocery when I could walk; say I buy a pineapple from Hawaii instead of an apple from Oregon—are noticeably harmful in and of themselves. It’s hard to say that I’m intending harm; surely I’m not. It’s hard to say that I’m doing much harm; in an intriguing analysis, climate and energy writer David Roberts does the math and calculates that the average American family each year is responsible for one 13.75 billionth of the increase in excess greenhouse gases. I can’t vouch for that exact figure; **the point is that none of us is doing much harm, but in the aggregate, over time, around the world, individual acts taken all together are empowering the carbon industries’ destruction of the Earth.** How can we puzzle through moral responsibility in a case like this?

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How climate change is like street harassment David Roberts on Nov 6, 2014

“the wires connecting climate victims to our torture devices are so, so long. The causal chains are complex, diffuse, and probabilistic. People can grok a 1-to-1,000 ratio. They can hold the number 1,000 in their minds, make sense of the context it provides. The “carbon budget” remaining to humanity before it exceeds the 2C threshold is around 825,000,000,000 tons. The average American household generates something on the order of 60 tons of direct and indirect CO2 emissions a year. So the average American household is responsible for 1/13,750,000,000 of the harm. That number is too large, or rather too small, for the ratio to make any intuitive sense. The distance between our acts and the aggregate harm they do is so vast as to utterly confound our imaginations.”

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“the extent of the aggregate harm of emitting carbon is not immediately apparent. It’s going to be decades before the number of people harmed by carbon emissions exceeds the number of people who benefit — and by then, of course, it will be far too late to do anything about it.”

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https://www.outdoorretailer.com/magazine/the-sustainability-paradox/?MarketingCode=PPCORSS1&utm_source=facebook&utm_medium=cpc&utm_campaign=Prospecting%3A+Lookalike%3A+Articles+Paid+Social+-+Copy

Oct 10, 2019

The Sustainability Paradox By Mike Geraci

"As derrick Jensen points out in his essay “Forget Shorter Showers,” which appeared in Orion Magazine, every action involved in the industrial economy (of which the

outdoor industry is a part) is destructive, and only through collective action can we impact larger and more degrading societal forces.”

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Book Laboratory Earth by Steven Schneider

“When we burn a lump of coal today, we’re recovering the carbon dioxide and solar heat of dinosaur times trapped in fossil organic matter. While it took millions of years to make a coal deposit, we’re releasing the CO₂ and other embedded chemical elements in tens of years. The speed of this human-accelerated process creates one of our biggest global problems and worries both climatologists and ecologists.”

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Sanders, Ella Frances. Eating the Sun (p. 9). Penguin Publishing Group. Kindle Edition.

Until you know precisely (or even vaguely) how and why the celestial bodies in our solar system work, their dancing is easy to take for granted. But once you do know, it is difficult to tear yourself away. Each of our unassuming neighbors, busy with a slow, dimly lit waltz during both long days and veiled nights—never stopping for breath, never hearing any applause, but certain that they must keep going.

Sanders, Ella Frances. Eating the Sun (p. 30). Penguin Publishing Group. Kindle Edition.

“It is a struggle, as the mapping of humans using things like mitochondrial DNA is incomplete, and the fossil dating methods also used to establish timelines for humans can be hit and miss. It is likely summed up best by genetic anthropologist John Hawks, who said that “a large-scale reorganization of the science of human origins is upon us.”

Our imperceptible differences are perhaps quite revelatory, but our sameness even more so—your DNA is entirely indifferent to what is written inside your passport; it is only concerned with a slow and ordered biological progression. The way we still insist on territories and borders, our frantic justification of cultural divides, it all begins to look strange and outdated and decidedly uncivilized in this genetic light.

It is clear that we haven’t quite figured out how to be just yet.”

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From footnotes in YOUR ATOMIC SELF

Stager, Curt. Your Atomic Self (pp. 247-248). St. Martin's Publishing Group. Kindle Edition.

CHAPTER 1: FIRES OF LIFE Calculations for the journey of an oxygen atom down your arm: The atomic radius of oxygen is 60 picometers (60×10^{-12} m; Slater, 1964), so an oxygen atom is 120 picometers or 120×10^{-12} m wide. If the atom’s diameter were to

inflate 10¹⁰ times, its diameter would be 1.2 m. For ease of calculations, let that be the height of a (short) person so the scaling factor to use on you will be 10¹⁰ times. If we also take the approximate length of a typical adult arm to be 0.6 m, it would convert to an equivalent distance of 0.6 × 10¹⁰ m, or 60 million km. At 0.62 miles per km, that would be 37 million miles, and to travel that distance in one second would require you to move much faster than the speed of light, which is “only” 186,282 miles per second. Einstein’s work on relativity showed this to be impossible.

Dimensions of components of a cell that has been magnified 10 million times to the size of a 300 foot hill: The diameter of a human cell is on the order of 10 microns or 10–5 m (Daniels et al., 1979), so magnifying it 10 million times (10⁷ times) would inflate it to about 100 m in height (roughly 300 feet). The diameters of structural microfilaments in cells are roughly 6–10 nanometers or 6–10 × 10^{–9} m (Fuchs and Cleveland, 1998). Magnified 10⁷ times, they would be 6–10 cm or roughly 2–4 inches thick. Mitochondria typically range in length between 0.5 and 10 micrometers or 5 × 10^{–7} to 10^{–5} m (e.g., Krauss, 2001), converting to 5–100 m, consistent with the size of a tractor-trailer truck in this example.

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Eating The Sun by Effa Francis Sanders

YOU’RE THE ONLY ONE I WANT TO TALK TO The motion of the Moon, something known as lunar theory, drove astronomers slightly mad for centuries; Isaac Newton said that it was the one problem that gave him severe headaches. There are many irregular aspects to its orbit, its eccentric longing, known as “perturbations,” which have kept people busy—and we still don’t even know exactly where the Moon came from. While it has a two-thousand-year history of investigation, we can now map lunar motion to a very high level of accuracy. Ours is the fifth largest moon in the solar system, but there are many, many others—Mars has a couple, Jupiter has at least sixty-nine. But ours is so companionable, so close, and it has a capital letter: it is Moon (if only because nobody knew or noticed for a long time that there even were any others, until Galileo found four moons around Jupiter in 1610). The influence of the Moon is far-reaching. Because of it, Earth has had an incredibly steady climate (at least compared to a lot of space), and its stabilizing effect on our rotation has been tremendously helpful, not to mention the fact that without it, evolution could well have played out very differently. If Earth had been alone and without lunar tides, for example, there would not have been the same dramatic fluctuations along coastlines, changes which could well have pushed along the evolution of very early biomolecules. While the Moon may be moving gradually away, the accumulative effect of lunar tides over millions of years means that we currently share a synchronous rotation—a movement similar to that between two dance partners. The Moon rotates at the same speed it revolves around Earth (it’s effectively been captured by us), which is why we see the same side of it all the time—a “despun” moon. It is also there and reassuringly present, always, much like the stars. We can’t see the stars during the day because the sky is too comparatively bright, but the Moon can sometimes appear even brighter during the day than at night. How glad we can be, that we have someone to figure out this

universe business alongside, to dance with, to gradually lengthen our days and keep us slow.

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WHAT EXACTLY AM I BREATHING IN While many assume “air” to just mean “oxygen,” that only accounts for 21 percent of what you’re breathing in. The rest of your lung soup is primarily nitrogen (78 percent), along with some other more unusual ingredients: other gases, contaminants and air pollutants, water molecules, dust, microbes, and spores from plants. You are also inhaling cosmic dust, the leftovers from things broken down in the outer atmosphere, which reach your insides in tiny yet massive amounts: you will definitely be breathing in particles from a meteoroid at some point this year. All of the molecules in the air are constantly colliding with one another at hundreds of miles per hour, and within weeks can have traveled around the world and been distributed throughout Earth’s lower atmosphere. This means that each and every particle has the potential to end up in your neck of the woods, in your lungs. Within a twenty-four-hour period, the average human will inhale about 9,000 liters of air, taking around 24,000 breaths per day, and more than 8 million a year. Someone who lives until the age of eighty may have taken more than 700 million breaths in their lifetime—unimaginable, wonderful, how easy it all seems. You rarely ever need to think about breathing, and it would be highly unusual for your respiratory system to ever forget what to do—your lungs, heart, and all the rest of it carries on without you really noticing. As it turns out, it might be worth thinking about. While breathing has long been thought of as an automatic process, one driven by the part of the brain that controls life—inherent things like heartbeat and sleeping patterns—it can actually change your mind. Breathing at different speeds, even paying less or more attention to the breath, has been shown to engage different areas of the brain. And we are among the only animals who can actually alter and regulate our breathing at will, consciously, rather than it simply happening in response to things such as running, resting, panic. Everything is fascinating, so don’t hold your breath.

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New Directions in Sustainable Design (pp. 179-180). Taylor and Francis. Kindle Edition.

Since water is 832 times denser than air, it has a significantly higher energy density. As such, more energy can be captured and channeled with water than with air (Figure 14.3). Because of this density, the body transfers about twice as much energy through radiant transfer— via the integrated circulatory and skin surface system – when compared with convective transfer. The human body is first a thermally active surface system. It is difficult to imagine how or why the human body would use air to heat and cool itself. The human body would be about 800 times the size it is. The size of the respiratory system, the diameter of veins and arteries that would channel air, and the caloric intake required to breathe the required air 14.3 Energy density of water and air would all be as absurd, as it would be inefficient. It is hard, then, to discern why buildings are designed and conditioned in this way. [See image in folder]

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