

# SOLARITIES

ELEMENTAL ENCOUNTERS  
AND REFRACTIONS

Edited by  
Cymene Howe  
Jeff Diamanti &  
Amelia Moore





## SOLARITIES



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Fig. 1. Detail from Hieronymus Bosch, *Ship of Fools* (1490–1500)

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*For Linda and her yellow mustang speckled with sunflowers*

*For Wesley and his radial engines*

*For Oxana and the promise of solar communism*



# Introduction

*Cymene Howe, Jeff Diamanti, and Amelia Moore*

The sun, our sun. Our star. A fiery, fuming benefactor. The force animating all lifeforms.

This is a book about the sun as an experience multiplied: what we are calling *solarities*. Here are a series of contemplations on the sun as an elemental form, its radiative potential, and how it shapes the conditions of living and being on earth. Elemental forms are those specific and situated characteristics of forces as they cohere and inhere in phenomena and experience — wind insinuating knots into a tree trunk, water cooling the skin, solar waves that spark photosynthesis in a wildflower. The sun is a force, but it is also a source of myth and symbol. Our goal in this book is not to capture the sun in its entirety through the metrics of astrophysics or the metaphors of literature or the magic of devotional practice or the capturing of its energetic powers.<sup>1</sup> Instead, our hope is to seek out solarity as a

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<sup>1</sup> The editors want to very sincerely thank Darin Barney, Imre Szeman, and Mark Simpson for hosting and organizing “After Oil School: Solarity,” out of which the inspiration for this volume came. For crucial perspectives on solar energy as a contingent force of social and cultural transformation, see Ayesha Vemuri and Darin Barney, eds., *Solarities: Seeking Energy Justice* (Minneapolis: University of Minnesota Press, 2022). On energy transi-

relational phenomenon, one that becomes arranged differently across distinct kinds of embodied, infrastructural, and materialized experiences. Solarities are felt through innumerable scenes of encounter. They are contingent and provisional, abstract, and agonizingly tangible, cosmological, and prosaic. Solarity is the source of all thriving on earth. But it is also, when wedded to the anthropogenic bodies of carbon hung in the atmosphere above us, the source of all withering and desiccation, a maker of monstrous heat.

Solarity pulls at the grammars of thought because its distribution is tricky to capture. Solarity refracts as the spectrum of light it produces bends to temperature, atmospheric pressure, and time. It radiates. It raises questions. How do we navigate our constant and evolving relationship with solarities, with the sun, our star? What persistent disparities appear on a planet that is so intimately bound up in a state of love and fear, reverence and dependency on the primary source of all life? All that matters. What might we learn if we embraced our solar being? And what becomes possible when the material specificities of solarities become the compass for our thought and actions? In eliciting solarities as a disposition of generativity, *Solarities* contributes to ethnographic and interpretive approaches across the social sciences and humanities that are coming to be understood as the *elemental turn*.<sup>2</sup> Attuning to elemental forms asks at

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tion and solarities' position as a source of conflict, relation, and paradox, see Imre Szeman and Darin Barney, eds., *South Atlantic Quarterly* 120, no. 1 "Solarity" (2020), both of which were also initiated and collaboratively crafted through the Solarity workshop.

- 2 See, for example, Jeffrey Jerome Cohen and Lowell Duckert, eds., *Environmental Ecocriticism: Thinking with Earth, Air, Water and Fire* (Minneapolis: University of Minnesota Press, 2015); Sasha Engelmann and Derek McCormack, "Elemental Aesthetics: On Artistic Experiments with Solar Energy," *Annals of the American Association of Geographers* 108, no. 1 (2018): 241–59; Sasha Engelmann and Derek McCormack, "Elemental Worlds: Specificities, Exposures, Alchemies," *Progress in Human Geography* 45, no. 6 (2021): 1419–39; Dimitris Papadopoulos, María Puig de la Bellacasa, and Natasha Myers, eds., *Reactivating Elements: Chemistry, Ecology, Practice* (Durham: Duke University Press, 2022); and Timothy



minimum for an interdisciplinary voice, but this collection also suggests an imaginative mode of investigating how solarities envelope, distribute, and refract solar possibilities. The shared endeavor in this book is to challenge ourselves with how solar becomes situated through its lateral dispersals as it is activated and actualized across atmospheres that are distinctive in time, place, and being.

Solarity is singular, a cosmic companion like no other for those of us on Earth. But is also shared across organic and inorganic bodies, shaped by physical form and material composition in unique and mutable ways. Solarity's influence is determined by geographical and historical constraint as well as arrangements of power, forces, and unsurprisingly, deceptions and aspirations. Each encounter with solarity is distributed differently, contorting and moving in ways that shift a sense of immersion in it, especially as it is everywhere and nowhere all at once. In this book, we ask contributors to consider how solarity is contingent, embodied, and embedded in material and symbolic relations. This means recognizing how solarity is a form and a force that plays out, across, into, and between bodies. Human bodies, nonhuman bodies, astral bodies. Solarity conditions all that is organic and alive. It is also integrated into inorganic things, materializing as concrete and plastic, shade, and melting ice. Solarity is embedded in the built world just as the built world often becomes refuge from and channel for solarity's powers. Solarity is composed into physical forms. It manifests as infrastructure in ways that are both explicit and unnoticed. Solarity is that precious line between thriving and expiration, blooms and growth, desiccation, and cessation. Solarity is a fractal tipping point between life and death, life and non-life, a never-ending pattern. It is at once everything and everywhere and because of its ubiquity, can be too easily overlooked. Dissipated. With *Solarities*, we gather attention to our

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Neale, Courtney Addison, and Thao Phan, eds., *Anthropogenic Table of Elements: Experiments in the Fundamental* (Toronto: University of Toronto Press, 2022).

sun's influence and its interference, its effects in the moment and over time, extended. Solarities are the sun in everyone, everything. A bright spark, a burning star.

### Solarity Is, Solarity Does

Solarity is captured in a joule, in a room, in her body as vitamin or as mutagen. Electromagnetic radiation proceeds. It goes and goes. It is radiance. It is a continuance. Solarity's biography is to reach toward the eternal. A lifespan that appears to be never-ending. And this is a promise. Five billion years of promissory. The sun is discharging. Pulsing out photons that will not leave its core for millennia. Only then is solarity delivered to earth. Like a gift of light and heat. On which it all depends. On which we are all depending. From core to corona to space, wrapping around objects in sensual form. Touching and contacting. Solarity is said, sometimes, to penetrate the skin, the atmosphere, the dark. But it may be better known as passive light, passive warmth. An antidote to the piercing logics of masculinist reason. What is the method of solar encounter? For the poet, writes Jane Bennett, solar contemplation involves "invoking one's inner coal, bird, and light in order to forge sympathetic links with the minerals in tools, the pigeons in the park, the myriad bodies."<sup>3</sup> Solarity settles as a fog of light and heat, knowing every curve of a surface, making its shadows, becoming the dark. A way of lingering.

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3 In "The Solar Judgment of Walt Whitman," Jane Bennett takes Whitman's form of solar judgment as a kind of "method" that imagines, sees, and feels every curve and every nook of a surface. In a section entitled "Solarity," Bennett quotes Whitman that "[the poet] is no arguer, he is judgment." The poet judges not as the judge judges but "as the sun falling round a helpless thing." For Bennett, the poet himself "goes solar" in order to linger long and to "linger with a mind that is open and quiet enough" to hear their testimonies rather than reflexively categorize and rank. Jane Bennett, "The Solar Judgment of Walt Whitman," in *A Political Companion to Walt Whitman*, ed. John E. Seery (Lexington: University of Kentucky Press, 2011), 136, 134.

Solarity is scalar paradox. It is worked into nearly every thing, transforming matter into a blush or a scar. It is existential and infinitesimal all at once. The sun, our benefactor. The constancy of those rays enlivens the planet. Omnipresent. Between Sun and Earth all movement occurs: compelling seasons, conjuring ocean currents, driving weather, climate, and belts of radiation. Solarity is a force that manipulates all. To call its powers vast is to greatly understate the reality. Our sun, the “yellow dwarf” that feeds us. A nearly perfect sphere. Nuclear fusion becoming light and heat to the point of incandescence. A mere 150 million kilometers separate the Earth and sun. If, on average, a person will walk 110 thousand kilometers in a lifetime, a trek to the sun’s outer corona would exhaust 1,363 lifetimes. It would be another four lifetimes to reach sun’s core.<sup>4</sup> And that would be an Icarus-like journey to be sure. Eventually, however, our sun will come to us. Except that we will already be gone. About 2.8 billion years from now, our sun will have created heat so extreme that all life on Earth will expire. Oceans will boil and then evaporate, never to return. In its red giant phase of evolution — in about 8 billion years — science says that the sun will eat our planet. Then it will settle into its white dwarf state. Sated.

Solarity moves us. From one phase to another. From day to dusk to night to dawn. Diurnal cycles of day making. It is a time machine. The infinite clock. Even without dials or springs or digital pulses, there is no temporal interval without it. Kyle Powys Whyte reminds us that our altered climate is about “happenings that unfold through time.”<sup>5</sup> And that talking about those changes, alterations, and transitions, “is an exercise in telling time.”<sup>6</sup> Solarity is such a time maker. There is no true away from the sun, the light of chronicity. Even in the dark, it is

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4 It would be another 432,000 miles to Sun’s core. See “Layers of the Sun,” NASA, n.d., [https://www.nasa.gov/mission\\_pages/iris/multimedia/layer-zoo.html](https://www.nasa.gov/mission_pages/iris/multimedia/layer-zoo.html).

5 Kyle Powys Whyte, “Time as Kinship,” in *The Cambridge Companion to Environmental Humanities*, eds. Jeffrey Jerome Cohen and Stephanie Foote (Cambridge: Cambridge University Press, 2021), 40.

6 Ibid.

always on the forever horizon. Always around the bend. In our minds and in our poetry. It is a proleptic rhythm of duration, expectation, and memory. If solarity is an elemental multiplication rousing what Anna Lowenhaupt Tsing calls the scalability of scale,<sup>7</sup> then it is a peculiar kind of deictic force since it never demures from pushing through the comprehensibility of scales as we know them.

Solarity is arriving. In daisies and dandelions and sweat. It is being taken up and transformed, its powers redistributed in photosynthesis, leafing and rooting. Solarity is bending. And it becomes bent into everything, the fibers in the Bonsai's bark, the back of your hand, the yellowy egg yolk consumed as cake. Robin Wall Kimmerer writes that, as human beings, we tend to view the world through the lens of anthropocentrism.<sup>8</sup> But plants, she notes, so radically different from us, sense the world in ways that are completely beyond us. Plants are more still. And their perception is parallel with that stillness, attuning to very long and very short wavelengths of light. Sunlight is deciphered through floral life. Photosynthesis follows a set of electrochemical processes that move energy across folded membranes within the symbiotic chloroplasts of green beings.<sup>9</sup> Natasha Myers recognizes photosynthesis as an “utterly magical, totally cosmic alchemical process,” one connecting all earthly plant life into a “reverent, rhythmic attention to the earth's solar source.”<sup>10</sup> With its heat and light, solar radiance has insinuated itself into all living forms.

The sun has been set. It has settled itself into a corpus of geofoms residing in the subsurface. Fossilized solarity is what Reza

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7 Anna Lowenhaupt Tsing, “On Nonscalability: The Living World Is Not Amenable to Precision-Nested Scales,” *Common Knowledge* 18, no. 3 (2012): 505–24.

8 Robin Wall Kimmerer, *Braiding Sweetgrass* (Minneapolis: Milkweed Editions, 2015).

9 Lynn Margulis, Dorion Sagan, and Niles Eldredge, *What Is Life?* (New York: Simon & Schuster, 1995).

10 Natasha Myers, “Photosynthesis,” in *Society for Cultural Anthropology*, January 21, 2016, <https://culanth.org/fieldsights/photosynthesis>.

Negarestani calls the Black Sun. The sun, underground. Radiant light and heat from past millennia have been recast into petroforms that ooze and leak, harden and burn. The reanimation of fossilized lives, Negarestani writes, stimulates a process of “eradication,” a “moving of the earth’s body toward the Tellurian Omega — the utter degradation of the earth as a Whole.”<sup>11</sup> This is also the sun, once set, now re-surfacing. The necrotic energetic potential beneath us. Oil is the corpse of solarility. A legacy. In fossilized bodies we confront the light of past sunshine, and to know the sun, now set in these mutated forms, begins with an awareness of our own diminution. Our own petrifying potential. Our own solar selves becoming petrified. Blackfoot scholar Leroy Little Bear<sup>12</sup> explains how the oil economy turns fossil beings into worldly threats, underlining how “narrow [our] conditions of existence” actually are. These fossils, reanimated, are not the only markers of our entanglements with a petrocapiatlist state of being. But they are some. Fossil fuels animate the political economies of nearly every place on earth. For Zoe Todd, the bones of dinosaurs and the remnants of flora and fauna from millions of years ago are paradoxical kin. She writes that fossil kin animate political economies but that “the insatiable desire to liberate these long-gone beings from their resting place, to turn the massive stores of carbon and hydrogen left from eons of life in this place” are a way of weaponizing these “fossil-kin, these long-dead beings, [transforming] them into threats to our very existence as humans.”<sup>13</sup>

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11 Reza Negarestani, “Cyclonopedia: Complicity with Anonymous Materials (Excerpt),” in *Energy Humanities: An Anthology*, eds. Imre Szeman and Dominic Boyer (Baltimore: Johns Hopkins University Press, 2016), 423.

12 Leroy Little Bear, “Big Thinking and Rethinking: Blackfoot Metaphysics ‘Waiting in the Wings,’” lecture, Congress of the Humanities and Social Sciences, University of Calgary, Alberta, June 1, 2016.

13 Zoe Todd, “Fish, Kin and Hope: Tending to Water Violations in *amiskwaciwâskahikan* and Treaty Six Territory,” *Afterall: A Journal of Art, Context and Enquiry* 43 (Spring/Summer 2017): 103–4.

## Refractions of Being

Solarity is power. Another fuel for productivity and its measure. People are fueled by many things. Some ways of fueling have brought pain, dispossession and toxic relations, and other powers appear with bright potential, an invitation to revolutionary horizons of environmental equilibrium in a world that feels itself unhinged. When solarity is made electric, or into comforting thermality, its appeals are tremendous. Solarity is transformed when it encounters photovoltaic panels crafted from the minor metals of silicon and cadmium, gallium and indium, selenium and tellurium. Absorbing and converting. The sun endures in its shining generativity. A zenith for energetic optimism. Solarity offers its power, freely it seems, to become our power. We will take it. And we might take it for granted. Thanks to you, benevolent star. Solarity portends a sunny flood of energy abundance. Many glorious refrains about harvesting the sun's powers ring out in the imaginary of solar energy made electric. This is unsurprising, given that the continuous energy the sun bestows upon earth is more than 10,000 times the world's total energy use.<sup>14</sup>

Solarity is a social condition, not only an energy source. We have grown used to worrying over the finitude of resources, and how the angst of expiration can be misrecognized and unconsidered. It can be tempting to celebrate solarity as categorically distinct from the resources responsible for modernity's uneven and restricted distribution. But that discursive undercurrent to solarity masks the violent structures into which any new resource will get economized. Solarity has the ability to reproduce the extractive logics, ideologies of progress, and technoutopianism that fuel liberal capitalism as Imre Szeman and Darin Barney show.<sup>15</sup> An apparently insatiable human desire

14 See "Top 6 Things You Didn't Know About Solar Energy," *Energy.gov*, June 6, 2016, <https://www.energy.gov/articles/top-6-things-you-didnt-know-about-solar-energy>.

15 Imre Szeman and Darin Barney, "Introduction: From Solar to Solarity," *South Atlantic Quarterly* 120, no. 1 (2021): 4.



for power pairs well with solarility's plenitude. While there is enough power for all in the promise of solarility, it also true that such abundance rarely gets distributed evenly. A more thoughtful and just reckoning with solarility could change that.<sup>16</sup> With "intersectional ecologies," as Sarah E. Vaughn, Bridget Guarasci, and Amelia Moore show,<sup>17</sup> environments, bodies, sites, technologies, and practices are all contingent social facts, predicated upon their formations and their outcomes. Solarility is that sort of unsettled entity and its unfolding powers should be understood analytically, generously, and deliberately with an eye to powers great and small.

Solarility can bring pain. It sometimes delivers death. Overexposure. Hyperthermia. Witnessing and then documenting the effects of solarility upon migrants attempting to survive the desert of the Mexico-US border, Jason De León writes about this perilous crossing, of bodies and sun, of nation-states on the edge of one another. In the endless desert, migrants must carry water bottles to survive. Some have been told that they ought to paint the plastic bottles black, like shade. This will keep the water cool. But the opposite is true. Solar radiation seeps into the dark more rapidly. US government programs have weaponized the desert, pushing migrants into extreme environments. Solarility is its artillery. Many deaths that occur there are never discovered. Solarility thus becomes a form of necroviolence.<sup>18</sup> Men laboring in the sugar cane fields of Central America, as Alex Nading finds,<sup>19</sup> face a different kind of solar malaise. Working long days under the scorch of a tropical sun, their kidneys have begun to inexplicably fail. At first, it seemed that pesticides were to blame. Now, the disease appears to gestate when the body has

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16 See Vemuri and Barney, eds., *Solarities*.

17 Sarah E. Vaughn, Bridget Guarasci, and Amelia Moore, "Intersectional Ecologies: Reimagining Anthropology and Environment," *Annual Review of Anthropology* 50 (2021): 275–90.

18 Jason De León, *In the Land of Open Graves: Living and Dying on the Migrant Trail* (Berkeley: University of California Press, 2015), 213.

19 Alex Nading, "Heat," *Society for Cultural Anthropology*, April 6, 2016, <https://culanth.org/fieldsights/heat>.

reached a “thermal tipping point.” These are solar pathologies, the slow, thermal violence of peripheral labor, somatic manifestations of solarility’s mutative powers where laboring bodies are made expendable.<sup>20</sup> Melanoma. Malignancies. Solarity is a kind of suffering. But its existence can also be attuned to more benevolent encounters.

Heliocentrism was a revolution. The Copernican turn in the mid-sixteenth century slowly shifted the planetary focus, from earth-centrism to sun-centrism. A cosmological turn. But the revolution was not really new. Already, people everywhere were worshipping the sun. On every inhabited continent the list of solar deities is long. For science, moving from geocentrism to heliocentrism was a readjustment to the solar scheme, a new ordering of arrangements. Spheres of influence were re-cast. Heliocentrism allowed for the decentering of Earth as the axis of cosmological truth. Amitav Ghosh asks whether such new sensibilities of recognition, not unlike those we encounter now, are coincidence. Or are they an indication that there are entities in the world, or tethered to the world through astral attachment, that are fully capable of inserting themselves into our processes of thought? He wonders, if that is so, couldn’t it also be said that the earth has itself intervened to revise many, if not all, habits of thought? Are we not living in a moment when nonhuman forces have the ability to intermedialize directly into human thought, human action, human being? We could wonder whether a new heliocentrism might hold more decenterings still. On Earth, the epoch of heliocentric awareness has not been fair or equal. Not for humans and not for nonhumans either. In works of sci fi, like those by Octavia Butler,<sup>21</sup> we find trenchant critiques of colonial fantasizing about extrasolar voyages. Zakiyyah Iman Jack-

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20 If, as Dipesh Chakrabarty argues, “the mansion of modern freedoms stands on an ever-expanding base of fossil fuels.” The wage slavery replenishing that mansion is premised on an intensive exposure to unmediated climate violence. Dipesh Chakrabarty, “The Climate of History: Four Theses,” *Critical Inquiry* 35, no. 2 (2008): 208.

21 See, for example, Octavia Butler, *Dawn: Lilith’s Brood* (New York: Aspect Books, 1997).

son reminds us that “the imperialist dimensions of terrestrial and extrasolar narratives of exploration, discovery, conquest, and settlement” have failed us, collectively, if unevenly.<sup>22</sup> If we were to refuse narratives of extrasolar conquest, might a neoheliocentrism draw us back to earth? There may be possibilities and potentials within a neoheliocentrism that offers a more considered revolution to re-schematize earthly powers and the arrangement of the status quo. Within this neoheliocentrism, sun remains foundational, the orbital apex, but its distributed powers of vitality and thriving are more evenly diffused and dispersed, a source of plentitude that is cast wide.

### Embodiments, Infrastructures, Materialities

Solar relations are always intimate relations between bodies, always sensed across organs, and drawn to the elemental diffraction of solar light and energy. In our first set of essays, authors speak directly to the modes and experiences by which solar relations get internalized in and as bodies — bodies both drawn to scenes of solar energy and repelled, or punished by them. As Oxana Timofeeva underscores in her work, solar elements exist within humans themselves. “Without being identical to the sun,” she notes, “a human eye bears resemblance to it. We can look at this object and see it because in certain aspects we are akin to it. The sun and the eye communicate as if they are looking into each other through the layers of things encompassed by light, and the one reflects the other.”<sup>23</sup> At the scale of the body, solar energy matriculates through skin and follicles, by way of retinas drawn to illuminated sources of use and pleasure, and through those entities that manage the miracle of converting solar energy into botanical mass. An elemental politics alert to the specific sensorial and biosemiotic scale of the body is one that centralizes sub- and trans-individual embodied relations.

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22 Zakiyyah Iman Jackson, *Becoming Human: Matter and Meaning in an Antiracist World* (New York: NYU Press, 2020).

23 Oxana Timofeeva, *Solar Politics* (Cambridge: Polity Press, 2022), 6.

Our most direct and daily experience of the sun is an epidermal interface with the solar spectrum. In Mél Hogan's "Skin," solar excess enters the scene as a warning that "the sun can kill you." Raising questions of knowledge by way of what solar radiation unleashes at the cellular scale, Hogan asks after a notion of solar's force over non-identity. Can the skin read solar and can it in turn be read as a form of environmental information since a sun burn is felt before it is seen? Hogan narrates an experience of "being jolted into a mediatic medical spectacle through which solar radiation is diffracted into meaning." In this encounter with solarity and its outcomes, Hogan's sense of self becomes temporarily amplified by proleptic forces (in anticipation of its becoming) and the analeptic (a restorative agent) of diagnosis.

But how does a body's external interface read solar differently when we shift our attention to botanical mediation? In an elemental reading of poetry by Isobel Armstrong and Rosemary Horn's chlorophyll prints, Aster Hoving offers an analytic inflected by the rhythms paced by chlorophyll in a variable relation to photosynthetic process. In Hoving's interpretation, the chemical aesthetics of chlorophyll invite a unique concept of vision not reducible to the rational eye/I. This is because "seeing is not a discrete act, separated from what is seen. Instead, vision is a tactile sensing of the interconnection of sunlight and materials. Seeing, in other words, is solar." But so too, Hoving goes on, is breathing — the lion's share of atmospheric oxygen on earth is respiration carried by plant bodies in photosynthetic conversation with solar energy. Embodied relation to the sun is thus mediated across an elemental spectrum that far exceeds the dominance of vision.

Botanical bodies read solar energy as chemo-synthetic relations with atmospheric gases, ultraviolet rays, and chloroplast conversions with elements drawn from the soil. Agronomic signatures of colonial and extractive mineralogy can also be read into the bodies of plants and their productivity. In Jeff Diamanti's analysis of phosphorous — one of the two key elements combined to create synthetic fertilizers — the question of how plants become big business is also a question about where on earth

solar surplus is dug-up. It becomes a question of how phosphorous comes into bodies, human and nonhuman, through an agroindustrialized biosphere that grows bigger and denser, reaching ever higher toward the sun. The lion's share of internationally traded phosphorous for big agrobusiness comes from a mine under military occupation by Morocco. Although phosphorous is ubiquitous — including in human DNA, bones, and cells — the industrialization of plant life is premised on the continued displacement and military domination of the Sahrawi people indigenous to this phosphorous-rich territory, a political ecology that is literalized in and as bodies all over the world.

From the lithic origins of our planetary predicaments to the mutualized entanglements that distribute solar energy into lived and relational ecosystems, Ayesha Vemuri and Hannah Tollefson turn to the sylvan ecologies breathing and storing the elements animated by our planet's solar orientation. They begin: "Respiration is a process of absorption and exchange that is always shared. It names the means by which living beings assimilate and expel carbon and oxygen through lungs, gills, stomata, or cellular membranes. An elemental process engendered by solar-ity, plants, animals, and other living beings' respiration unfolds in conjunction with photosynthesis." This elemental process is one that happens in and through plant and microbial networks of mutual dependence, both in contiguous ecologies and places made intimate by currents carrying air. Tracked at this scale, Vemuri and Tollefson "think with respiration as a process that constitutes forests simultaneously as sites of breath and life, as places of commodification and precarity, and as ecologies that hold lessons for mutual flourishing."

Embodied relations of solar-ity often invite a discourse of productivity and yield, a thermodynamic frame for ratifying precisely the industrial logic into which energy as work became an organizing principle of capitalist social management and its horrors. In a counter-productivist reading of solar surplus through George Bataille, Robin Kimmerer, and Oxana Timofeeva, Cara New Daggett draws out what might be described as an energetics of generosity in excess of capitalist capture. From

the body to the subject of late petroculture, Daggett focuses on the leitmotif of work and argues that solar energy belies the twin poles of scarcity and entropy haunting the capitalist imaginary. “The pursuit of solarity as a political theology can help to reframe the abolition of fossil fuels in the West, not as the relinquishment of the power of demi-gods, but as the pursuit of a different kind of glory, and a different kind of pleasure. And not in the name of sustainability or labor itself—as if the goal of subsistence could ever provide enough aesthetic resources to convene a mass desiring-machine—but to spend energetic abundance better, more sumptuously, as gifts without return, with a luxurious, ‘wild exuberance’ that sustains communal wealth and beauty.”

In a playful inversion of the work-energy nexus long ago politicized by George Caffentzis and the Midnight Notes Collective, Gretchen Bakke asks us to consider our own alignment with energetic profiles, an effort to open the body’s facility with energy flows more deliberately. How are the different parts of a typical day aligned with specific energetic capacities and by extension desires, drives, activities, and moods? Sending an email or binging a Netflix series; drinking a morning coffee over paper print or taking an Uber to the airport; digging in the soil with a hoe and distributing feed over a plot of land for husbanded animals. “What fuels you,” Bakke asks, and what might these experiences of fuel precipitate for an energy transition in which efficiency metrics will become both more tyrannical and more malleable? “Check your productivity level, are you learning to do less with more, taking the lesson of the solar panel and putting about 22 percent of your potential energy to good use, and then just hanging out and taking long naps on the lawn?”

Where Bakke rephrases the subjects of energy according to efficiency, Jason De León details an embodied relation to the thermal extremes of the Sonoran Desert separating northwest Mexico from Arizona and California where nearly four thousand migrants have been left to die since 1990 “from hyperthermia, dehydration, and the many other complications that result from prolonged exposure to the sun.” What analytic style is

required to shift the critical gaze from capital's calculus of work to the weaponizing of solar exposure where qualities of an arid expanse of land is fashioned into an apparatus of punishment and deterrence? "In the Sonoran Desert," De León writes, "the sun is the Border Patrol's primary weapon." De León introduces a critical interpretive method through the technical possibilities materialized by photography, where ISO, shutter speed, exposure values, and aperture converge to prevent overexposure to solar light. De León thus reads the bleached, dehydrated body of the migrant left to die alongside the ethical question of how to approach the forensic image where violence is an effect of solar exposure and solar exposure is the condition of its evidence.

In our second section of the book, the conceptual and material forms of infrastructure operate as an analytic and improvisational space. As Brian Larkin has so effectively phrased it, infrastructures are "material forms that allow for the possibility of exchange over space."<sup>24</sup> In the form of mediational entity, the sun may have no parallel in its capacity to both animate and decimate all that its radiative potential touches. Solarity operates as infrastructure as it enables, conveys and communicates latent possibilities. Infrastructures, like solarities, need not be instrumental. They are just as easily sensual metaphors or ruinous systems. Infrastructures are made things but they are equally what is made of them and in finding the solar points of inflection across infrastructural encounters, we circle back to the paradigmatic infrastructure of solarity itself.

As the city of Santiago, Chile lurches skyward and the built environment rises ever higher, terrestrial life takes on new shadows as well as new political forms. Embedded in the contradictions of modern infrastructural aspirations, Cristián Simonetti tracks the material form of concrete, the most abundant anthropogenic rock on earth. Designed to be an impermeable platform for the built human world, concrete also suffocates nutrients and energies required by soils and plants. "Natural yet cultural,

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<sup>24</sup> Brian Larkin, "The Politics and Poetics of Infrastructure," *Annual Review of Anthropology* 42 (2013): 328.

geological yet social,” writes Simonetti, “this synthetic rock sits literally on the edge of both.” Concrete production, it turns out, is “silently tied to the powers of our primary star.” The first paradox of solarity is that it fostered the creatures of the Cambrian explosion that became the petrified exoskeletons to be burned as limestone in the creation of concrete. The second paradox of solarity, Simonetti notes, is that it is in concrete that much of the world’s population now shelters itself from a warming atmosphere, seeking shade from a hotter and hotter world.

In “Affective Energies,” Myles Lennon asks us to reflect on the politically poignant question of how we dream about the sun, and he invites us to engage with the affective qualities of solar infrastructures. When we are able to move beyond a crude technophilic distillation of energy into megawatts and gigajoules, Lennon argues, we can also begin to shift away from a historically violent naturalism that splits humans from the environment and confront the limits of our technologies. Solarity is an emotive and evocative cipher for activists and others who multiply view the allure and risks of “shine.” The affective energy of the sun conditions a particular erasure of the human. And, as Lennon writes, “solarity conspires with silicon machines in a moment of climate catastrophe to inspire an ethos of nonhuman nature.” Although solar infrastructures may appear to spring organically from the ground, they are in fact, cultivated through extractive economies tied to silicon and tetrachloride, abusive labor conditions, and racial capitalism.

Ian Alexander and Nicole Starosielski take up questions of justice and carceral violence in their incisive examination of how sunlight becomes weaponized. They find that sunlight, itself, is not a resource equally accessible to all, but is instead mediated by architectural, technological, and discursive infrastructures that are acutely apparent, and often brutal, in the US prison system. They write that “by paying attention to solar media, it is clear that solarity is not simply an orientation to the sun-power that scaffolds biological and social growth — it also extends through numerous forms of social violence.” In the denial of sunlight to prisoners in solitary confinement for example, “asolarity” mate-



rializes as a method to enact harm. Here, the sun becomes a tool of carceral violence. Asolarity is not the inversion of solarly, but the perversion of it — bending sunlight into a cudgel for the operations of the prison industrial complex.

With a critical attention to solar media that parallels Alexander and Starosielski, Aylin Kuryel offers her interpretation of the film *Nothing but the Sun*, a collaborative effort between the filmmaker and Ayoreo people. In this work Kuryel finds exposure doubled. Film is exposed to light to create images and people are exposed to colonial logics through the objectification of media infrastructures. As she writes, “exposure emerges as a caustic condition on multiple levels; the exposure of the film to the light produces the image, which then exposes people to the colonizers by turning them into objects of knowledge, enabling locating and targeting.” The sun itself, once a source of worship and vitality among Ayoreo populations, also doubles as a deadly force, parching the land now that trees, and their unique arboreal architecture, have been felled to make way for animal agriculture. Solarly, for Kuryel, can too easily operate as a colonial weapon as its effects take hold over time and across representational forms.

For Rhys Williams, solarly performs particular ontological and political aesthetics. It is an “interrupting surface” that plays upon a poetics of light and transparency. As solar energy infrastructures bloom across landscapes and horizons an imaginary begins to collectively form, one that pictures solar futures as without depth, impact or footprint. And yet, these sorts of aesthetic principles that have come to dominate popular, corporate, and activist representations of solar technologies also have the capacity to erase the deeper historical contingencies of land, power, and light. In critically analyzing a popular television serial, Williams locates the narrativized qualities of solar dreaming in satirical form. A key trope of the series that he explores is how “solar interrupts a particular relationship to history and land and establishes a new arrangement, where our attention is instead drawn to the future, and upwards, to the sun.”

In “Living Too Close to the Sun,” Daniel Barber turns to the supertall residential towers of Manhattan, which appear as pinnacles of luxury and exclusivity, both of which are “expressed in height, proximity to the sun.” But these sorts of towers are also, he shows, a form of architectural excess. Infrastructural giants on the horizon, these vertiginous residential infrastructures boast of sun-soaked perches high above the chaos imagined to be below. But their solar abstraction is largely superficial given their need for carbon fueled resources, from concrete to climate-controlled interiors. As they seem to reach toward solarity, they are equally enmired in petromodern impulses that tie them to the extractive present despite their orientations toward futurity. “Luxury and exclusivity here,” writes Barber, “at least in a schematic, diagrammatic fashion, [capture] a more general condition: architectural concepts of value and innovation are caught up in the priorities of capital, making them difficult to align with the capacity for solar liberation.”

At the Apex Landfill just outside of Las Vegas, Nevada we encounter the world’s largest dump: 50 million tons of garbage (and counting), festering in what Bob Johnson calls the “fat heat” of the southwestern desert. “A rotted head of lettuce. Flies and larva. An old leather couch. Cowskin withered in the desert sun. Razors, rubber duckies, nickel-cadmium batteries, toenail clippings, old receipts, scraps of bone, a toothbrush. This admixture of humanity’s health and decrepitude, its aspirations and miseries, its kindnesses and crimes,” is, Johnson writes, “tossed together without distinction.” As a tool of liberalism, he finds, the landfill works to conceal the detritus of fossil capital as it shuttles material entropy from sight. In the glaring solarity of its location, however, the Apex is also exposed as an infrastructural home for misfits, anomalies and marginal things. Solarity reveals the rotted objects that were once objects of desire and in so doing unearths fractured traces of a system based on commodities and capital.

In an excerpt from his serialized graphic novel, *The Solar Grid*, the artist Ganzeer draws a sickly Earth and two Cairo orphans who have grand plans to change everything. It is 949

years after a global flood of scriptural magnitude and the world now relies on a vast grid of off-planet solar panels to power its entire industrial infrastructure. Night-time is no more, and all the world's clean water is contained in a network of towers called Skyquench, built by the richest man on earth. In this sci-fi dystopia, the sun that shines is not a stellar body but an infrastructural one that inflicts shadowy inequalities. But for Ganzeer, as for his orphaned protagonists, there is still hope in the light beyond the grid.

Our last set of interventions are organized around specific substances and objects that materialize solar relations in explicit ways. Materialities surface here in other-than-human beings and through the things that solarities creates or sustains. In vital forms, solarities emerge through the bones and bodies of sea creatures crafting shadows and light for possible futures on a hotter planet. In non-living forms, solarities appear as the built world, morphing and burning under the logics of settler colonial logics. Solarities surface relations of labor, capital, and power and solarities materialize relations, of both organic thriving and inorganic endurance, convening in new imaginaries.

In “The Ray and The Flame, or, What it Takes for the Sun to Shine,” Tim Ingold questions the explanatory power of physics and psychology, making a case — in a solar turn — for their fusion. He writes that only by repudiating the bifurcation between the two worlds of matter and energy, and “of mind and meaning” can we know the light that shines as sun, which is itself both ray and flame. Like the sky itself, the light that shines as sun is not only physical or perceptual, but instead belongs, as Ingold puts it “to the phenomenal or atmospheric order of reality.” The radiative power of the sun is real and acute, but likewise is it a “luminous experience” and therefore an encounter with light as both a form of geometric ordering and vital energy. Utilizing both European and Incan examples of solar imagery over time, Ingold asks how the sun's rays are as socially emotive as they are physically palpable. By attending to these patterns and divergences between the ray and the flame we come closer to

recognizing that solarity “is an order constituted by the fusion of the cosmic sphere with the sphere of affect.”

Amanda Boetzkes extends Ingold’s hypothesis when she writes, “Solarity thus poses the question of how to interpret material histories.” In her essay about environmental archeology in the Arctic, she shows how settler interpretations of solarity are reflected in scientific dating technologies that subject Indigenous cultural objects to linear evolutionary teleologies. But rather than succumbing to the positivist logics embedded in these narratives, Boetzkes describes how Inuit people experience solar radiation in an elementally expressive way through the sculptural use of sun-bleached whale bones. Instead of relying on the archeological interpretation of light and bones, those who make a life in the present with the bones of the past form geocultural connections, mythologies, and relationships with these objects the sun has consumed over centuries, and with *tupilaq*—bone figures that take on power and force when conjured in the shadows. The complex and entangled material connections between waves of ancient peoples in the Arctic, the contemporary Inuit, whalebones, and *tupilaq* are invisible under the “controlled illumination” of settler archeology. Is there an alternative relationship between solarity and material culture that can bring about a more heterogeneous form of Indigenous renaissance?

For Kim Förster, the liberatory potential of solarity runs the risk of being eclipsed by the kiln, the crucible that materializes cement as the bonding agent of modern industrial development. Solarity, then, should direct our attention to building materials as a substantive part of the fantasy of industrial capitalism that “cheapens nature” and contributes to the “slow violence of the climate crisis.” As the sun’s evil twin, the kiln has extended fossil fuel-based regimes around the world, becoming a site for the generation of lethally vibrant matter in the twentieth century. There is no “sustainable cement” argues Förster, and thus no solar salvation for this industry. Relational solar thinkers must instead advocate for dismantling the building industry and its culture of building. He writes, “The kiln carries an infinitely

tragic futurity, whose planetary consequences one cannot conceive: the combustion of thousands of tiny suns, given the number and rising production volume of cement plants worldwide,” and he concludes, “We have to align with the sun and learn to question the kiln.”

In Dominic Boyer’s spare, one-act play “Twilight” we encounter three characters prognosticating on the vague future they think they may see in the distance. But they are not sure. They bicker. They delay. They come up with solutions. They remain confused and yet somehow certain in their reckoning with the catastrophe budding around them. Racing to put out a fire, they eventually build a structure, rocky and unsure, but one that nevertheless moves them still closer to the “crepuscular spectacular.” One blithely states to another: “How brilliant. How decisive. We’ve been doing nothing but waiting and watching for I don’t know how long.” A measured response comes in return: “We wait and see if it’s real this time. There have been so many false dawns and fake dusks. I’m not getting worked up about another one.” Their theatrics ensue but their pointed searching remains earnest. In the end, what they see is left to us, as audience, to decide as the materiality of potential futures fades and brightens on an enigmatic horizon.

Taking up the question of building materials and materializations, Caroline Levander introduces us to the world of Earth Ship construction and a present-day reality in which discarded tires have become their own form of natural resource. Made from “carbon black” and other fossil fuels, tires are transformed from refuse into a strange sort of harvest “grown” from the earth’s materials to make durable building components. Advocates of the Earth Ship ethos live within the material relations of “domestic solarify,” wherein they hope to reverse global warming through household level building, design, and repurposed materials. A renegade architect, Earth Ship craftsman and “biotecture” evangelist sees tires not as trash but as more akin to trees, a building material grown from solarify through the sooty material of carbon black and then activated as thermal mass. “Tires grow here,” he explains. “They are indigenous to

the entire planet. I can always find tires. There is no place I can go where I don't find tires."

The dream of a greener economy is also materialized by harvests of seaweed in the Gulf of Maine. Sarah Besky describes the rise of rockweed, a seaweed species that has been commodified in order to anchor a settler coastal economy now threatened by rising sea temperatures and the migration of lobster from regional waters. She argues that "changing coastal economies reframe the sun and the objects of its light into new forms of value and property," showing how local populations' relations with seaweed have led to new settler laws that reframe coastal property rights so seaside homeowners can own "their" rockweed and the profits that stem from it. These profits were once generated from an intertidal commons, meaning that new legislation effectively extends private property regimes into the ocean. Besky contrasts events in Maine with seaweed economies in Southeast Asia where similarly warming oceans make aquaculture more precarious for the women who have become the primary laborers in that industry. Solarity, materialized in seaweed, is thus amplifying settler colonial logics and economies in one part of the world while exacerbating the disparities of gendered developmentalist economies in another.

Of course, rising ocean temperatures affect blue-green economies and material relations in more places than New England and Southeast Asia. In our final essay, Amelia Moore takes us to the islands of The Bahamas where the sun has long been a physical and affective resource for the (neo)colonial sun-sand-sea tourism industry. She shows us how the sun has been commodified in beach vacations, the fantasy of solar powered sustainable tourism ventures, and most recently in the growing industry of for-profit coral restoration. Moore hopes that both solarity and coral will be rescued from the supremacist trap of colonial or corporate world making ventures. When the material relationality of solarity is complimented and extended by the liberatory relational thinking of Black feminist artists, scientists, and intellectuals, then Bahamian biogeophysical realities become legible as a kind of Black Atlantis, "an imperfect process

by which marine restoration, in this case via coral reefs, anchors emergent and resistant materialities of knowing and being in the Caribbean.” Perhaps we can also see glimmers of a radical neoheliocentrism in these emergent material worlds.

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# Skin

*Mél Hogan*

The surgeon carved out a hunk of flesh. Forever after the scar will be the scalpel line, with wisps of pink and white where sutures made knots, barriers against infections. Plucking out the stitches, the doctor inquired about childhood sunburns — apparently even one bad burn as a kid could explain this. Doctor said they'd caught it in time. How lucky. Use sunscreen, he said, the sun can kill you.

What happens next is the parsing of the skin. Reading solarly. The sun as hostile information. Or the skin as hostile informant. Being jolted into a mediatic medical spectacle through which solar radiation is diffracted into meaning, he says, “let me know if anything changes,” as though I’m qualified to read my own body in this way. Am I qualified? My sense of self becomes temporarily amplified by both the proleptic (in anticipation of its becoming) and analeptic (a restorative agent) diagnosis. I was the one to spot the tiny mole near my ankle after all. For months I’d tell myself to get it checked.

But I don’t feel like I’m dying. Am I dying? I call a friend and ask her this. “Am I dying?” She says she doesn’t know. The physician’s assistant tells me it’s urgent that I come in the office for a full body scan. I’m not sure I feel the sense of urgency.

What happens next is the reading of the skin, as a surface, the search for the oddly shaped, too dark, uneven. My skin is the medical screen, read across for signs of life, illness, death. The doctor reads my skin quickly, diagonally, like he's done this a hundred times before, a hundred different skins. He's looking through my hair. Between my toes. Just like every doctor that would examine me after, this one tells me about Bob Marley, how he could have had his toe amputated to save his life. But the doctor says that, really, pale white skin with many different kinds of moles is the most dangerous skin.

A year later the dermatologist asks me why I'm there. "A yearly checkup," I say, "don't I have a file?" The process is of being reminded. I don't know why I'm there. Two years, a few more scars, but none necessary, all superficial, all cautionary. No phone call. Three years, and he says, "you don't have it," and I nod along and put my clothes back on. But I don't know what this means. What's the it? Where is it? Am I it?

Delighting in his own knowledge, the doctor stops me as I get ready to leave and lets me know that "it's genetic." That I should urge my brother to get himself checked. I tell my mother that the doctor said it was "genetic" and she says that that's ridiculous. Nobody has had this in the family. What happens next in the reorientation to family, to generations, to what's inherited, to mutation, to decisions I've made about sun exposure, to decisions my parents made for me when I was a kid.

This one is on (in) me, a somatic mutation that spontaneously arose in a cell in my body. A different mutation might have simply contributed to genetic diversity, theoretically a healthy thing for the species. But a rogue mole is just a defect, a glitch in the code.

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In reading my skin, and the experience of mediated skin as a form of social text, I consider all the ways in which its data is more valuable than this simple reflection offers. Skin has

become part of the genomic industrial complex. For 24 USD you can purchase a DNA collection kit for DNA Gene Skin (Skinetics) informing you that “DNA is the key to learning what works for your skin.”<sup>1</sup> Ever since the idea of the gene came to be, it’s been in its perpetually unfulfilled promise to be the key to just about everything that it delivers anxiety-based products and services with so much purchase. With *HomeDNA™ Skin Care*, for example, you get a “science-based DNA test that identifies your skin’s genetic potential in seven key areas” — with this one, for a mere 134 USD, you can get your “skin decoded” to better understand your “collagen quality, skin elasticity, fine lines and wrinkles, sun protection, pigmentation, skin antioxidants, and sensitivity.”<sup>2</sup> For these companies, skin DNA tests are for “ailments,” such as sunspots and wrinkles and cellulite — things that are skin deep and can be “fixed” with cover up, moisturizer, or various beauty products. Some of these creams offer DNA repair, which proposes a new depth to skin.

And if we read deeper?

Do I cease to be myself as my genetic makeup is modified by radiation or is somehow altered? After the doctor excises part of my leg, does my genomic profile reflect this? Gene expression can change in one’s lifetime, known as “epigenetic drift,” and interpretations of one’s genome are subject to what’s been sequenced and mapped by the industry, made at that time, in those contexts, and usually to for-profit ends. Genes also change with gene science. And with the growth in popularity of direct-to-consumer genetic testing, the dogma of the gene, as causal or deterministic, has made it difficult to think outside of those logics and parameters, and to embody more than a sequence of ATCGs, the building blocks that make up the DNA molecule.

I think back to the White House’s 2003 announcement of the first map of the human genome, when I was 26 years old. President Clinton equated the human genome with a code for

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1 “DNA Gene Skin (Skinetics),” *Luminary*, n.d., <https://luminary.com/dna-gene-skin-skinetics>.

2 Ibid.

life: “Today we are learning the language in which God created life,” he stated plainly and proudly.<sup>3</sup> He also paraphrased Galileo, who insisted that the universe itself was written in the language of mathematics in order to make the same point about our genomes, that they’re just letters, numbers, codes. The event was a religious celebration, a confirmation that God exists and that science is merely at the service of decoding the meaning of life. The scientific religiosity that was the basis for the launch of the Human Genome Project has deep roots, and two decades later these remain within the philosophy of Evolutionary Creation (EC) held by many prominent US-based scientists. On a website featuring Evolutionary Creationist thought, it explains that EC includes two basic ideas: “First, that God created all things, including human beings in his own image. Second, that evolution is the best scientific explanation we currently have for the diversity and similarities of all life on Earth.”<sup>4</sup> While science and religion have often been viewed as necessary adversaries, genomics is so complex and magnificent that it brings us back to cosmogony and cosmology.

Genomics begs for a universal theory — a settling of the creation myths and origin stories about life — something that will explain everything about ourselves and render it tangible, editable, and controllable.

With a new code for life, we can determine good and evil, the worthiness of some over others, as conscripted by God. Biopolitics. Historically, we’ve done this many times before, of course, but now we have the potential to index and compare every living being. Faith, literally, in the genome also renders concrete thinking of the body — and maybe life or death itself — in datafied and newly commodifiable ways. Biocapitalism. Only 1–2 percent of our genome encodes the necessary information to make a protein, to then perform some function within our cells,

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3 National Human Genome Research Institute, “Draft of the Human Genome Sequence Announcement (2000),” *YouTube*, August 29, 2012, <https://www.youtube.com/watch?v=slRyGLmt3qc>.

4 “What Is Evolutionary Creation?,” *BioLogos*, November 4, 2022, <https://biologos.org/common-questions/what-is-evolutionary-creation>.

and the remaining 98–99 percent is “non-coding DNA.” Scientists don’t know exactly what makes a gene express itself given that all the cells in our body have the same DNA but do different things—become nail, neuron or skin. And even though only 1 percent of the human genome unites and distinguishes us from one another, as human individuals, the genomics industrial complex would have us believe that our genetic differences hold great power, great importance, shifting attention away from the impacts of social conditions and the environment. It’s easier to control humans from the inside than from the outside. Bio-power.

It makes it hard to think about life, my body, death, illness, healing, the cause, the cure, the sun, and my skin in ways that aren’t flanked by either the science or the religion of genes. My relationship to the sun is forced into a molecular one, encoded by God and decoded by scientists.

What happens next is a resurfacing. A reskinning. One might think that a kind of self-scanning obsession develops, or that one becomes scared of their skinsuit, or that the sun becomes an enemy, but these things didn’t happen for me. Without the sun, we’d freeze and be left in the dark, we’d be in free fall in space, with nothing for the planet to orbit around, and we’d get low on serotonin, vitamin D, and our blood pressure, bones, and brains would quickly become defective. The skin incases and mediates this reality and makes a vital connection between outer space and inner space. Life is the sun in skin.

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# Chlorophyll

*Aster Hoving*

Chlorophyll, as the green of leaves, attunes us to photosynthesis and the seasonal growth cycles of plants. The pigment is produced in the chloroplasts of plants to transform the energy of light into chemical energy, or sugar. In this sense of turning sunlight into energy, chlorophyll is similar to the photovoltaic panels of solar energy infrastructures. But whereas solar power companies see the fluctuations of the sun as a problem to overcome, working to gain permanent access to its rays to generate a stable and profitable energy supply, chlorophyll makes visible embodied relations to the sun that stay embedded in seasonal changes.

Chlorophyll allows plants to store sunlight in leaves to use as energy when needed. As such, chlorophyll mediates the sun, transforming its energies and redirecting parts of the color spectrum of its waves. We encounter this mediation as the color green because chlorophyll recasts the blue and red wavelengths of light. As Jeffrey Jerome Cohen argues, colors designate environmental actants with material effects.<sup>1</sup> Green, in this case, sig-

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<sup>1</sup> Jeffrey Jerome Cohen, "Introduction: Ecology's Rainbow," in *Prismatic Ecology: Ecotheory beyond Green*, ed. Jeffrey Jerome Cohen (Minneapolis:

nals chlorophyll as an actor that materializes the light of the sun. As the pigment makes solar energy available to plants, it also makes it available to those who consume the mediated afterlives of the sun in the form of leaves, roots, flowers, and fruits. The green appearance of chlorophyll is relational.

Moreover, chlorophyll is sensed by an embodied observer. Solarity illuminates the colors of leaves since they emerge as materials absorb and reflect light differently. These materials include our eyes: that colors are even available to our sensorium is because our eyes and chlorophyll both respond to a small part of the electromagnetic spectrum called visible light. This means that the sunlight required for photosynthesis also sustains vision. Theorized as such, seeing is not a discrete act, separated from what is seen. Instead, vision is a tactile sensing of the interconnection of sunlight and materials. Seeing, in other words, is solar.

In the northern hemispheric spring of 2016, I took a picture of an ivy branch that brings together, all at once, the multiple colors that leaves can take over time (fig. 1). On one end of the branch the leaves are a light green, while further down they change to yellow, orange, and deep red. I am not sure whether this is a kind of ivy that changes its color and sheds its leaves seasonally. California, where I took the picture, knows a variety of species commonly referred to as ivy and they occur both as deciduous and as evergreens. Perhaps its bare branches and various hues are due to other elemental entanglements such as the dry conditions in which summer deciduous plants shed their leaves. But this branch also brings into focus how, in particular deciduous trees and plants, solarity materializes seasonally. The combined shades of this ivy as such make thinking about fluctuating solar relations possible. If chlorophyll sensitizes us to seasonal growth, the different colors and the shedding of leaves attune us to seasonal discharge. I want to suggest that, taken together, these solar mediations complicate desires for continuous green growth fueled by permanent access to the sun.

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University of Minnesota Press, 2013), xiii.



Fig. 1. Ivy branch. Photograph courtesy of the author.

Specifically, an analysis through and with chlorophyll brings into focus that notions of perpetual growth assume an economy detached from space and time and thereby also from solar fluctuations. Perceptive definitions of fossil fuels as solar cycles accumulated over long stretches of time have shown that these materials, as fuel, provide a sense of continuous availability of the sun.<sup>2</sup> Andreas Malm thus refers to fossil fuels as the “stock,” which to him stands outside space and time as finite reserve, as opposed to what he theorizes as the endless spatial and temporal “flow” of green energy.<sup>3</sup> These are provoking concepts that explain capitalism’s historical reliance on fossil fuels, but they also inhibit analyses of the imaginaries of green capitalism. A more nuanced understanding of green and fossil fuels starts with acknowledging that fossil fuels are not external to space

2 Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London: Verso, 2013), 12, and Andreas Malm, *Fossil Capital: The Rise of Steam-Power and the Roots of Global Warming* (London: Verso, 2016), 41–42.

3 Malm, *Fossil Capital*, 38–42.

and time: they are simply (re)generated on timescales foreign to human experience. Furthermore, green energy does not flow permanently. Stating that the flow “hangs like a fruit for anyone to pick” obscures that fruits grow seasonally and are, therefore, neither continuously nor effortlessly available for picking.<sup>4</sup>

Chlorophyll complicates the apparent separation between the stock and the flow, and the separation between the social and the ecological it enables, as the pigment is a stock of available energy that seasonally turns back into other temporalities. Isobel Armstrong’s poem “Defining Deaths” aptly envisions this process in deciduous trees as a “weightless” release of energy, referred to as the “trees’ past,” built up over the course of a year:

the trees’ past is alight  
 incandescing in cell and fibre  
 blazing veins and capillaries  
 squander aura  
 the year’s store of sun  
 leaves weightless  
 time falls radiant  
 light’s afterlife flares from the ground<sup>5</sup>

Before returning to the significance of this “leaves weightless,” I want to draw attention to the descriptions of passed time stored in leaves as “alight,” “blazing” and “radiant” as it “flares from the

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4 Ibid., 372.

5 Isobel Armstrong, “Defining Deaths,” in *Infinite Difference: Other Poetries by UK Women Poets*, ed. Carrie Etter (Exeter: Shearsman Books, 2010), 18.

ground.”<sup>6</sup> These images speak to the moment when the earth moves away from the sun and the days become shorter, meteorologically beginning in March for the southern hemisphere and in September north of the equator. The amount of chlorophyll in a leaf then decreases because sunlight is required for its production. When the chlorophyll in a leaf breaks down, other pigments change it into the radiant colors described in the poem. Xanthophyll and carotene, yellow and orange pigments, have been present in the leaf all along but were masked by a dominant amount of chlorophyll. In some species, anthocyanin, a red pigment, is produced in response to lower temperatures and fewer daylight hours.

Hues of yellow, orange, and red, as the afterlives of sunlight, seem to remind the poem’s speaker of the blazing sun that provided the energy for the leaves to grow, but this fire of colors also signals the discharge of this year’s work of photosynthesis. Armstrong’s phrase “leaves weightless” helps us do the work of thinking energetic stocks and flows as relational rather than oppositional by distinguishing a different kind of accumulation.<sup>7</sup> If accumulation, as a concept, straddles both capital accumulation and the accumulation of chlorophyll in leaves, then the aesthetic economy of deciduous plants is integral but also troubling to economies of perpetual growth precisely because of its seasonal pattern of growth and discharge.

By designating the changing colors and shedding of leaves as weightless, Armstrong offers a vision of a gathering of time and energy that far from serving capital accumulation, or even being harvested, departs weightless as falling leaves. Capital works to prohibit chlorophyll and leaves falling weightlessly since all excess must be rendered productive, given weight, and serve accumulation. We see this in the energy infrastructures extracting solar surplus in the shape of fossil fuels as well as in the greenhouses of industrial agriculture, which seek to detach

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6 Ibid.

7 Ibid.

plants from the seasons and days to scale up fruit and vegetable production to a perpetual bountiful harvest.

Instead, Armstrong's falling leaves "squander."<sup>8</sup> They are accumulations of energy that bypass attempts to make capital of such effort. In this sense, my analysis speaks to George Bataille's theorization of a general economy in which the expenditure of energy and wealth, rather than continuously hoarding them, is the primary objective.<sup>9</sup> Bataille argues that a general economy functions like an organism, since these too must lose the energy they cannot use to grow without profit.<sup>10</sup> The leaves in the poem indeed change color and fall not to serve another round of capital accumulation but as part of a rhythm of growth and rest. As such, they return energetic stocks back into other flows. What distinguishes solarly from economies of perpetual growth, in the case of chlorophyll in leaves of deciduous plants, is a seasonal rhythm of both accumulation as well as release.

Like Malm's fossil capitalism, green capitalism too seeks to free itself from ecological rhythms. Whereas fossil fuels initially powered seemingly permanent and endless growth, green energy is supposed to keep fueling such an economy. Thin solar panel films in the shape of leaves, developed by Solliance Solar Research and recently picked up by design firm Studio Roosegaarde, illustrate the persistent naturalized image of solar energy as incompatible with extractive economies (fig. 2).<sup>11</sup> Solar panels shaped like leaves buttress the idea that renewables are "a practically immediate result of solar radiation, existing prior to or apart from human labor, incorporated in the landscape,

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8 Ibid.

9 Georges Bataille, *The Accursed Share: An Essay on General Economy*, vol. I: *Consumption*, trans. Robert Hurley (New York: Zone Books, 1988), 9.

10 Ibid., 21.

11 @SRoosegaarde, "This is a solar panel! Prototyping at Studio Roosegaarde #sun #energy #innovation," *Twitter*, August 21, 2020, <https://twitter.com/SRoosegaarde/status/1296829039408222208>. For the Solliance Solar Research version of the solar panel see @SollianceSolar, "(zeker 5 jaar oude) zonnecellen van @SollianceSolar #opv. Misschien liepen we wat ver voor de troepen uit. pic.twitter.com/UENaRHdnb7," *Twitter*, August 31, 2020, <https://twitter.com/SollianceSolar/status/1300433715831681024>.

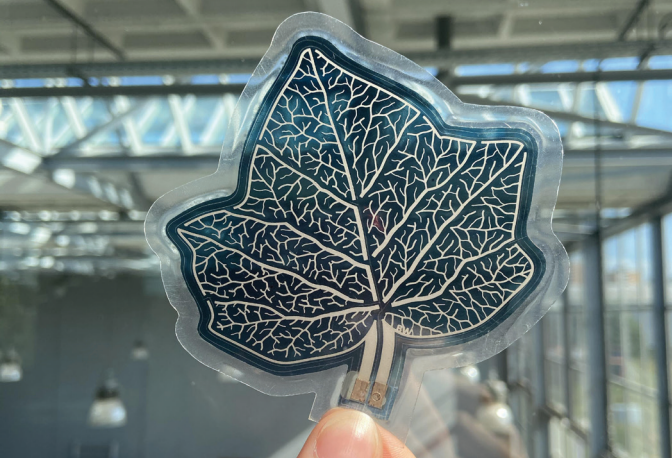


Fig. 2. Leaf-shaped solar panel. Photograph courtesy of Studio Roosegarde.

captive of the cycles of the weather and seasons, undiminished at its source by consumption,” or, more concisely, antithetical to capitalist appropriation.<sup>12</sup> But when we consider infrastructural imaginaries such as *GENESIS*, a belt of solar panels around the equator, or a solar farm orbiting the earth conceived by *NASA*, we recognize continued attempts to free the sun’s energy from planetary temporalities.<sup>13</sup>

These imagined infrastructures aim to perpetually position silicon, the chemical element most used in photovoltaic systems, in the light of the sun to continuously extract the electric current generated in this exposure. To traverse the rhythm of the seasons and day and night to obtain permanent access to the sun, these projects imagine ways to detach solar mediation from

<sup>12</sup> Malm, *Fossil Capital*, 41–42.

<sup>13</sup> For further description and critique of these two infrastructures, consider Hermann Scheer, *The Solar Economy: Renewable Energy for a Sustainable Global Future* (London: Earthscan, 2009), 83–84.

the boundedness of a specific place or to escape the surface of the earth all together.

Thinking with chlorophyll counters such imaginaries of decoupling solar energy from spin and space by attending to temporalities specific to place. Chlorophyll, in other words, situates solar energy temporally and materially. As the earth turns around the sun and around its own axis, the aesthetics of solar mediation in leaves follow the relative position of the earth to the sun. Another instance where we see these situated mediations in art is Rosemary Horn's chlorophyll prints. As I will explain, the aesthetics of Horn's prints work by formalizing planetary solar temporalities.<sup>14</sup>

Horn's chlorophyll prints use the light sensitivity of leaves as their photographic medium. A chlorophyll print is made by placing a positive film, or another high contrast image printed on transparent paper, over a leaf and then exposing those two to the sun. A positive film is one in which the areas most exposed to light are the lightest areas of the transparent print. This process, such as in the leaves of "3 Textures, Weeds, Introduced Species," paradoxically causes the leaf to retain its green color in the darker areas of the image while the areas exposed to the sun are bleached (fig. 3). In a sense, the printing process reverses the aesthetic logic of chlorophyll accumulation as I have described thus far, which is likely related to the fact that the leaves Horn works with are picked. A picked leaf is no longer part of a liv-

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14 In the lecture "One Sun, One Leaf, One Afternoon," Horn explains that her practice is inspired by a range of photographers that explore the aesthetics of ecological processes by using them as medium, such as Heather Ackroyd and Dan Harvey, Lloyd Godman, Susan Derges, and Binh Danh. Danh also makes chlorophyll prints, but I am working with Horn here because of her explicit interest in the technique as a sustainable medium. "One Sun, One Leaf, One Afternoon. Lecture at the Plymouth College of Arts, 15 October 2009," *Rosemary Horn*, n.d., <http://photogirl.co.nz/wp-content/uploads/2016/11/Rosemary-Horn-Plymouth-College-Lecture-Oct09.pdf>.





*Fig. 3.* Rosemary Horn, “3 Textures, Weeds, Introduced Species.”  
 Photograph courtesy of Rosemary Horn.

ing plant that perpetually generates chlorophyll to use as solar energy.<sup>15</sup>

Nevertheless, Horn’s prints are embedded in planetary rotation around the sun and composed by diminishing chlorophyll as aesthetic agent. I propose to think about this as elemental aesthetics, which materialize out of a sense of ecological vulnerability or precariousness and as such their formal qualities do not master but instead adhere to ecological affordances and constraints. If green capitalism’s fantasies of solar limitlessness are tied to a notion of mediation independent from material and temporal forces, then elemental aesthetics are inextricable from the ecologies they mediate.

Horn’s works especially foster thinking through capital and chlorophyll accumulation because they yield other conceptions of rhythms of growth and fall. The elemental aesthetics of the prints appear as intersection between a range of more and less chlorophyll in different parts of a leaf. Chlorophyll decreases in the uncovered areas while the amount of chlorophyll remains stable in the areas where the leaf is shaded by the dark parts of the image. Horn’s works encompass both an abundant presence of the sun in summer, peculiarly not the form of green bio-

<sup>15</sup> A major thanks to Rosie Horn for pointing this out when she generously read and commented on a draft version of this essay.

mass but as bleached areas, and the scarcer availability of the sun during the winter months, also in reverse as bright green areas rather than in the form of biomass transitioning to different colors. In other words, chlorophyll prints emerge as aesthetics of relation between storage and waste, or energetic stocks and flows. This relationality contradicts the separation required for extraction and helps us redirect attention away from distinguishing between fossil and green fuels and towards politicizing both.

The elemental aesthetics of chlorophyll printing furthermore push definitions of capitalist economies as, inspired by Bataille, either the “fundamental prohibition of expenditure,” or the “permanent expenditure” that defines Jonathan Crary’s theorization of 24/7 capitalism.<sup>16</sup> The problem, Horn’s work suggests, is perhaps not either continuous wastefulness or the prohibition of waste, but the notion of permanence. The permanence and endlessness of growth economies require the bifurcation and isolation of the growing and falling of leaves as well as the separation of energy production from its use. Materially and conceptually isolating energy, growth, and decline as such underwrites a sense of social independence from fluctuating ecologies.

Horn’s chlorophyll prints, however, are inextricable from the rhythmic oscillations of the sun and chlorophyll. That is, the seemingly seasonally stable green color of leaves relies on a plant being alive to keep the production and use of chlorophyll as energy in perpetual motion, which in Horn’s chlorophyll prints means that the green of a leaf once it is picked is no longer used nor regenerated and its aesthetic logic is reversed. The processual rather than permanent nature of chlorophyll as a solar energy form is thus equally a challenge for the permanence of Horn’s work, a challenge I faced myself when framing three distinctly red, yellow, and green leaves: all of them have turned

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16 Amanda Boetzkes, “Solar,” in *Fueling Culture: 101 Words for Energy and Environment*, eds. Imre Szeman, Jennifer Wenzel, and Patricia Yaeger (New York: Fordham University Press, 2017), 315, and Jonathan Crary, *24/7: Late Capitalism and the Ends of Sleep* (London: Verso, 2014), 10.

brown by now. As such, the prints question notions of sustainability based solely on the renewability or carbon emissions of different fuels. Horn's work helps us to think of sustainability, instead, as temporal and material situatedness.

Finally, in both Horn's work as well as in the leaves of living plants, the aesthetic agent responsible for the elemental aesthetics of seasonal colors is not a human artist but the chloroplasts of leaves. Chlorophyll and chloroplasts are agential in the sense that they materialize solar energy as chemical energy and because, as Natasha Myers argues, photosynthesis makes the world of breathing creatures by releasing, almost incidentally, the oxygen that they need.<sup>17</sup> Plants respire too, but they need less oxygen than they produce. That the oxygen supporting all other breathing life forms is a byproduct of photosynthesis recasts the idea of the human, as if there ever was such a thing as the universal human, as dominant lifeform. After all, chloroplasts and their photosynthetic sibling mitochondria simply outnumber us, as biologist Lynn Margulis reminds us.<sup>18</sup> Breathing is one more bodily process making apparent that far from the only aesthetic agent in a subordinate world, people depend on chlorophyll's photosynthetic attunement to the sun.

The variations of chlorophyll, in sum, challenge our conceptual vocabulary to understand social processes not in the context of a static environment, but as entwined with and dependent on fluctuating elemental solarities. As embodied and embedded relation to the sun, chlorophyll brings into relief how making the sun into a profitable resource requires a seeming decoupling of solar energy from a position on a moving planet. Every time the seasons change, as leaves turn into their radiant colors and

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17 Natasha Myers, "Photosynthesis," in *Anthropocene Unseen: A Lexicon*, eds. Cymene Howe and Anand Pandian (Earth: punctum books, 2020), 317.

18 Lynn Margulis, *Symbiotic Planet: A New Look at Evolution* (New York: Basic Books, 1998), 38. Margulis's work on the symbiotic rather than Darwinist evolution of chloroplasts and mitochondria might be another example of how attending to chlorophyll opens up conventional conceptions of the social.

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foliage is shed, chlorophyll makes visible solar relations different from those chasing solar-powered perpetual growth.

## Note

This essay is based on the chapter “The Celestial Sphere: Positions of the Sun in Green and Blue” from my master’s thesis, *Elemental Aesthetics: Sun, Wind, and Tides Beyond Green Energy*. If it has improved at all, in the meantime, that is thanks to the editorial precision and intellectual generosity of Jeff Diamanti and Cymene Howe.

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## Bloom

*Jeff Diamanti*

Figure 1 overleaf shows a phosphorus mine. Nearly seventy percent of internationally traded phosphorus comes from this place. Neither the phosphorus nor the political conditions surrounding the functioning of this mine get much attention in environmental discourse, at least not directly. But phosphorus is an element on the periodic table that is uniquely important to the production of industrial fertilizers, and exponentially so since the standardization of the Haber Bosch process patented in 1918, a patent awarded the Nobel prize in chemistry in Stockholm and credited with nearly doubling agricultural yield in the twentieth century, which explains the intensive arc of what earth scientists now regard as the Great Acceleration. This mine is in the center of the contested Western Sahara, under military occupation by Moroccan forces since the 1970s, and backed by the US and Israel since the early 2020s. Its borders are a war zone, contested by the socialist liberation army of the Sahrawi Democratic Republic, the Polisario Front.

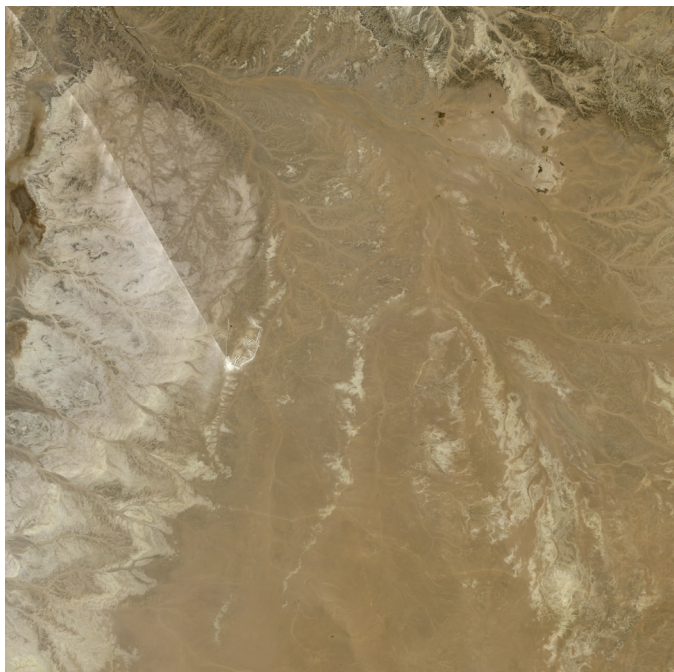


Fig. 1. “Bou Craa, Western Sahara,” NASA Landsat 5 – TM and 7 – ETM+ (January 20, 1987).

This mine marks the terminal edges of what Martin Arboleda calls the “planetary mine.”<sup>1</sup> Terminal, since phosphate fertilizers give the value form of capital its shape in motion between intensive yields of biomatter on one end, and the rise of photosynthetic bloom events turning coastal waters hypoxic (i.e., closer to terminal decline) all over the world. The geographical arc of this stuff drawn up here as it travels from mine to bloom involves a recasting of how we might read solar energy and its manifestation as elemental amplification.

1 Martin Arboleda, *Planetary Mine: Territories of Extraction under Late Capitalism* (London: Verso, 2020).



According to the United Nations Environment Programme, primary nutrient loading of global marine ecosystems has doubled since 1950. “Before the industrialization of the western world, the annual flux of nitrogen from the atmosphere to land and aquatic environments was 90–130 million tons per year and phosphorus 1–6 million tons per year. Anthropogenic sources have created an additional flux of 200 million tons of nitrogen and 10.5–15.2 million tons of phosphorus per year.”<sup>2</sup> Upwards of 60 percent of this additional tonnage comes from industrial fertilizer runoffs along tributaries and rivers, collating with alluvial sediment as currents carry eroded soils rich with minerals out into coastal waters. In warmer and heavier waters, this elemental collation subtends the hydrological equivalent of global forests, where over fifty percent of primary marine bioactivity reproduces at a respiratory interface with the atmospheres, fixing carbon and other elements into bodies as they exhale over half of the oxygen we breathe. But when excess nitrogen and phosphorus mixes with spring bloom of diatoms, phytoplankton, and other microorganisms, and those organisms exceed trophic containment, those same waters turn eutrophic, and the water column stills into a quiet death known as a red tide, or a hypoxia event.

Red tides are dead zones — nothing can live there except for cyanobacteria and seafloor organisms — and their negation of life follows suddenly from life’s ecstatic unfurl. In 2021, the great dead zone of the Gulf of Mexico measured 6,334 square miles.<sup>3</sup> The largest on earth, in the Gulf of Oman, measured 63,700-square mile in 2019. In 2022, there were 415 reported dead zones on earth, and most of them are increasing in scale. What kind of critical inquiry does the rise of red tide and the coming of hypoxia ask for? What kind of concept of historicity gets materialized between this dialectic of expansive life

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2 “Nutrients,” *United Nations Environment Programme*, n.d., <https://www.unep.org/cep/es/node/150?%2Fnutrients=>.

3 “Happening Now: Dead Zone in Gulf 2021,” *Ocean Today*, n.d., <https://oceantoday.noaa.gov/deadzonegulf-2021/welcome.html>.

and sudden death? And how might twenty-first-century bloom ecologies unnerve normative habits of humanities research? What currents in the history of radical critique get summoned by this intimacy between frenzied life and mass death?

I want you to try to think with me about the involvement of life in currents that carry these tides — your life, the channels of nutrients, energy, and resources that your body takes in, and the supply chains and contracts, conflicts, and erasures that fold into that current — but also current as a kind of medium understood kinetically, as in the ostensibly autopoietic force of aeolian winds and oceanic overturn. And think with me too about the historicity of capital's ontology as one of those strong currents now written into the geological and climatological record of the planet.

Phosphorus is particulate and particular, and it grounds the inorganic composition of twentieth- and twenty-first-century capitalism. Phosphorus is just about the most banal substance on planet earth. It does not *do* a lot, look like much, or react in any spectacular way. Unlike oil, coal, or uranium, there is not a lot of potential energy stored up in phosphorus, at least not kinetic or thermal energy. Its value to the mining industry and agricultural sector is wholly other to the value of gold, copper, or bundles of wheat. If you were to hold phosphorus in your hand, there would not be much to say about its affective or aesthetic properties, except that it is nearly indistinguishable from the ground in which you found it in the first place.

The ground in which phosphorus does its work, however, is a good place to begin this story, because this story is about the fundamental capacities that phosphorus affords life on earth, anxieties about the future, so-called “peak phosphorous,”<sup>4</sup> and the cultural geographies that relate materially, politically, and economically in a geocultural era portended by late petroculture. Phosphorus is an element on the periodic table, and it is

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4 Dana Cordell and Stuart White, “Peak Phosphorus: Clarifying the Key Issues of a Vigorous Debate about Long-Term Phosphorus Security,” *Sustainability* 3, no. 10 (2011): 2027–49.

the twelfth most ubiquitous known to chemists. Like carbon and hydrogen, therefore, phosphorus is *the ground*. Which is to say, unlike copper or neodymium which is *of the ground*, and figured distinctly when encountered and yielded *from* the ground, phosphorus retains its *grounding* properties when extracted from the earth's lithosphere. You cannot burn or eat phosphorus in order to unlock its calories or kilojoules, and you certainly cannot fill up a gas tank with it, so since it is not especially potent as a source of energy, its elemental force and function requires a different ethnographic approach.

Phosphorus is a structuring element in organic chemistry: it provides DNA, bones, and cells with its material coherence and integrity. In short, phosphorus incorporates into *life* as form, as infrastructure, and not as content, not as information, code, or blueprint. Its analog is rebar, pulp, and bone. It is the plastic in the floppy disk, not the software written into the film. This is what makes it a contingent ingredient in industrial fertilizer. It isn't that plant life *eats* phosphorus. It is instead that their body's structural integrity *depends* on it.

Algae blooms and eutrophication are *limited* by phosphorus, which means that they cannot bloom beyond their chemical limit—beyond the point at which the oxygen in the water is entirely consumed, leading the inevitable bust of bloom—without the structural plenitudes of phosphorus. The life and nonlife distinction is both stabilized and made porous by the ubiquitous presence of phosphorus. The lithic truth of all life—its contingent manifestation through carbon, calcium, phosphorus, the animation of life by nonlife, by the inorganic—is written in the medium of long mineral cycles and life's provisional embodiment of those cycles. Between the mine and hypoxia are the currents carrying plundered phosphorus to the ports, products, and phytoplankton blooming into accelerated expansion, an elemental menagerie amplified by waters drenched in solar energy. What kind of critical inquiry do our shared phosphate futures ask for? Where the spectre of its depletion in the min-

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ing sector, revolt in occupied territory, or hydrological hypoxia, draw the currents of climate change into terminal futures?

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## Respiration

*Ayesha Vemuri and Hannah Tollefson*

*Respiration — the source of energy that lets us farm and dance and speak. The breath of plants gives life to animals and the breath of animals gives life to plants. My breath is your breath, your breath is mine. It's the great poem of give and take, of reciprocity that animates the world. Isn't that a story worth telling?*

— Robin Wall Kimmerer, *Braiding Sweetgrass*<sup>1</sup>

Respiration is a process of absorption and exchange that is always shared. It names the means by which living beings assimilate and expel carbon and oxygen through lungs, gills, stomata, or cellular membranes. An elemental process engendered by solar-ity, plants, animals, and other living beings' respiration unfolds in conjunction with photosynthesis. Photosynthesis is the process in which plants, algae, and other chlorophyll-containing beings transmute solar energy into chemical energy, creating the energetic basis of most life on earth. Through the process of

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<sup>1</sup> Robin Wall Kimmerer, *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants* (Minneapolis: Milkweed Editions, 2014), 344.

respiration, living beings break down this stored energy and use it for all the processes of life: eating, growing, reproducing, playing, working, breathing, thinking. Photosynthetic beings harness sunlight, carbon dioxide and water to form glucose, sugary potential energy, and release oxygen. Respiration reverses this. Cells use oxygen to break down that sugar to fuel life-sustaining processes, releasing carbon dioxide and water. The output of one process becomes the fuel for the other, creating a cycle of photosynthetic capture and respiratory consumption that affirms the deep codependence of plant and animal life.

Following the dynamics of energetic solar ingestion and expenditure, we want to think through respiration as a process of mutual breathing as it manifests in forest ecosystems. This focus is informed by our own encounters with forests as spaces where solarity infuses longstanding and dense biotic and abiotic relations, but also by the way these ecosystems are managed and valued for their “service” as planetary “lungs.” Here, we think with respiration as a process that constitutes forests simultaneously as sites of breath and life, as places of commodification and precarity, and as ecologies that hold lessons for mutual flourishing.<sup>2</sup>

Respiration names a biochemical process of elemental exchange, but for much longer has been associated with both air and animacy. From the Latin *re* (again, anew) + *spirare* (blow, breathe, be alive), to respire is to continuously breathe energy into life. While the sun is often deified as the source of planetary life, the earthly process of respiration mediates stored solar energy in cells to facilitate growth and expenditure in living beings. As chlorophyll containing organisms such as green

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2 Here, we are drawing not only on the work of Indigenous scholars and thinkers whom we cite below, but also the work of movement builders and activists like adrienne marie brown, whose concept “emergent strategy” looks to nonhuman beings for lessons on shaping human worlds in ways that encourage mutual flourishing. See adrienne marie brown, *Emergent Strategy: Shaping Change, Changing Worlds* (Chico: AK Press, 2017). For an incredible example of such lessons, see Alexis Pauline Gumbs, *Undrowned: Black Feminist Lessons from Marine Mammals* (Chico: AK Press, 2020).



plants, algae, and cyanobacteria, photoautotrophs capture carbon dioxide and water in the presence of sunlight to store it as sugar. Both photoautotrophs and heterotrophs (living beings that do not produce their own energy) imbibe this stored solar energy and release it in respiration. As environmental scientist and member of the Citizen Potawatomi Nation Robin Kimmerer writes, it is the twin, cyclical processes of photosynthesis and respiration that “lets us farm and dance and speak.”<sup>3</sup> It is through shared respiration that the sun’s radiation is translated into living matter.

As mediators of sunlight and carbon, trees have emerged as central protagonists in the contemporary moment of climate crisis, and forests as crucial sites for modelling, managing, and mitigating future climatic changes. Some studies present evidence of afforestation as a form of geoengineering that would inhale and capture overabundant carbon from the atmosphere.<sup>4</sup> Others warn that with increased temperatures and insect infestations, forests may act instead as precarious tinder boxes awaiting combustion and further carbon emissions.<sup>5</sup> The uncertain position and promise of forests in imaginaries of a future planetary ecology is often communicated in forms of representation such as homology and proxy.

Since at least the mid-1980s, campaigns against anthropogenic deforestation have articulated the value of forests in terms of their planetary metabolic function as the “lungs of the earth.” Environmental groups seeking to protect the old growth forests of Clayoquot Sound from logging in the 1990s mobilized the analogy to frame deforestation and forest protection as global issues. Appealing to forests as the lungs of the earth was a powerful metaphor that connected local forest protection to plan-

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3 Kimmerer, *Braiding Sweetgrass*, 344.

4 Jean-Francois Bastin et al., “The Global Tree Restoration Potential,” *Science* 365, no. 6448 (2019): 76–79.

5 Natasha Myers, “Photosynthesis,” *Society for Cultural Anthropology*, January 21, 2016, <https://culanth.org/fieldsights/photosynthesis>.

etary survival.<sup>6</sup> The comparison draws on a primary lesson of biology, that is, the symbiotic gas exchange between plants and animals. They breathe, we breathe. Forests as planetary lungs offer a scaled parallel of this mutual relation, demonstrating the deep dependence of humans and other animals on photosynthesizing beings.

Ecological equivalences are powerful means of shaping environmental imaginaries.<sup>7</sup> Pointing to the “inadequacies of direct knowledge,”<sup>8</sup> Chun notes that such figures enable a transcendence of scale and allow us to make sense of unfathomable processes that exceed comprehension. While they hold great pedagogical and affective power, they may also overly simplify and reify the very ecologies they seek to celebrate and care for. In a 1935 speech, the United States president Franklin D. Roosevelt claimed that as the lungs of the earth, forests purify the air and give strength to the American people. Known for his conservative preservationism and its connections to eugenic ideas and policies,<sup>9</sup> Roosevelt’s evocation of this phrase illustrates the danger of such simplifications, as forest management was enrolled into a white supremacist, nation-building project.

Though the analogy has long since existed in the public imagination, climate change has only increased the circulation of the notion, notably in the wake of forest fires around the world and deforestation in the Amazon. The valuation of sylvan spaces based on specific ecosystem services—natural processes that support biological and cultural life constructed

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6 Sarah Pralle, *Branching Out, Digging In: Environmental Advocacy and Agenda Setting* (Washington, DC: Georgetown University Press, 2006), 52.

7 Elizabeth DeLoughrey, *Allegories of the Anthropocene* (Durham: Duke University Press, 2019), and Ursula K. Heise, *Sense of Place and Sense of Planet: The Environmental Imagination of the Global* (Oxford: Oxford University Press, 2008).

8 Wendy Chun, “On Patterns and Proxies, or the Perils of Reconstructing the Unknown,” *e-flux*, September 25, 2018, <https://www.e-flux.com/architecture/accumulation/212275/on-patterns-and-proxies/>.

9 See Dorceta E. Taylor, *The Rise of the American Conservation Movement: Power, Privilege, and Environmental Protection* (Durham: Duke University Press, 2016).

as the “benefits that people get from nature”<sup>10</sup> — is a model of conservation that assigns ecological spaces and features monetary value based on their use-value *for* particular humans. In other words, ecosystem service models are forms of commodification that render such spaces precarious to changing market pressures. Described as planetary lungs, forests and other spaces valued for their carbon-capturing potential are treated as “sinks.” As “land-based places to store waste,” sinks are both technoscientific instruments and often, as Métis/Michif scholar Max Liboiron argues, colonial technologies that presume access to Indigenous lands.<sup>11</sup> Furthermore, though some forests are protected on the basis of their ability to act as sinks for anthropogenic carbon waste, older forests may be logged or reforestation efforts abandoned if they fail to hold and capture waste.<sup>12</sup> Trees do not simply filter air and store carbon, but in respiration and combustion, release it. Thus, forests valued for capturing carbon face abandonment or destruction for performing their own life-sustaining processes.

Framing forests as lungs tends to focus primarily on the photosynthesizing and carbon storing capacity of sylvan ecosystems and fails to account for the complexity and mutualism of breath as the “reciprocity that animates the world.”<sup>13</sup> By conceiving of forests in terms of their utility, the comparison forecloses understanding the “social life of forests”<sup>14</sup> and the complex interdependencies among animal beings and our arboreal kin. Respiration is a symbiotic process, perhaps best understood as occurring in *conspiracy* with other beings. *Con* + *spirare* is to

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10 “Payments for Ecosystem Systems,” *World Wildlife Foundation*, n.d., [https://wwf.panda.org/discover/knowledge\\_hub/where\\_we\\_work/black\\_sea\\_basin/danube\\_carpathian/our\\_solutions/green\\_economy/pes/](https://wwf.panda.org/discover/knowledge_hub/where_we_work/black_sea_basin/danube_carpathian/our_solutions/green_economy/pes/).

11 Max Liboiron, *Pollution Is Colonialism* (Durham: Duke University Press, 2021), 40.

12 Myers, “Photosynthesis.”

13 Kimmerer, *Braiding Sweetgrass*, 344

14 Peter Wohlleben, *The Hidden Life of Trees: What They Feel, How They Communicate, Discoveries from A Secret World* (Vancouver: Greystone Books, 2016).

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*Figs. 1a and 1b.* An account of the ecosystem services provided by a tree in Square Saint-Louis, encountered on a neighborhood walk in Tio'tia:ke (so-called Montreal). Photograph by Ayesha Vemuri.

breathe with, to breathe *together*, albeit in an “unequally shared milieu.”<sup>15</sup> Despite varied conditions of breathability, breathing together is a relational act that earthly dwellers engage in to maintain a life-sustaining world. Breathing with forests requires us to rethink our models and analogies of forest beings. Seeing forests and other ecologies as “gifts and guides”<sup>16</sup> rather than commodities foregrounds reciprocity and gratitude.<sup>17</sup>

Solar energy, transmuted into stored carbon through photosynthesis, moves through spaces outside the purview of the sun’s rays, deep into the soil. Nicole Starosielski’s notion of “embedded solarities,” which names “the ways that solar energy, effects, and affects permeate the environment itself” turns our attention to the ways the sun’s radiation suffuses even subterranean ecosystems.<sup>18</sup> In such spaces, trees and their fungal co-conspirators together create the symbiotic communities that we call forests.<sup>19</sup> Vast mycorrhizal networks “stitch organisms into relation.”<sup>20</sup> As hyphae (filamentous strands of fungi) penetrate root tips at the cellular level, they trouble the idea of individual life forms.<sup>21</sup> Using these dense interspecies networks as channels for sharing nutrients and information, trees communicate, support, and compete with one another: “mother” trees nourish young saplings, healthy trees care for ailing or ageing ones, trees warn one another of pests and disease, all while contending for sunlight.<sup>22</sup> Mycorrhizal fungi maintain forest health by decom-

15 Timothy Choy, “Distribution,” *Society for Cultural Anthropology*, January 21, 2016, <https://culanth.org/fieldsights/distribution>.

16 Anna Lowenhaupt Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University Press, 2015), 2.

17 Kimmerer, *Braiding Sweetgrass*.

18 Nicole Starosielski, “Beyond the Sun: Embedded Solarities and Agricultural Practice,” *South Atlantic Quarterly* 120, no. 1 (2021): 15.

19 Wohlleben, *The Hidden Life of Trees*.

20 Merlin Sheldrake, *Entangled Life: How Fungi Make Our Worlds, Change Our Minds & Shape Our Futures* (New York: Random House, 2020).

21 Suzanne Simard and Daniel Durall, “Mycorrhizal Networks: A Review of Their Extent, Function, and Importance,” *Canadian Journal of Botany* 82 (2004): 1140–65.

22 Wohlleben, *The Hidden Life of Trees*.



posing organic matter, providing protection against pathogens, “fixing” atmospheric nitrogen, and transporting water.<sup>23</sup> Plants provide their fungal companions with sugars produced through photosynthesis, imbuing the dark understory with converted solar energy. These subterranean webs of connection ask us to follow the sun underground, into the soil. They invite us to approach our conception of life under the sun with a deep sense of humility—a word that etymologically derives from *humus*—regarding our entanglement with other beings. For Kimmerer, it is humility that allows us to learn from other species and to become teachable.

As we write this essay in the midst of a global pandemic, brought about in large part by anthropogenic ecosystem destruction, learning from the conspiracy of forest beings is an increasingly urgent task. We echo Achille Mbembe’s suggestion to conceive of breathing as “that which we hold in-common with other humans and all other living beings.”<sup>24</sup> For Mbembe and others, this moment breaks down delusions of individualism, requiring that we “answer here and now for our life on Earth *with others* (including viruses) and our shared fate.”<sup>25</sup> Conspiring is a deeply political act, underscoring the ways in which breath and respiration are at the center of struggles for life.

Unequal conditions of breathability in both so-called postcolonial and settler-colonial contexts are saturated with histories and ongoing processes of colonialism and imperialism. As the ongoing movement for Black lives coincides with the Covid-19 pandemic, disproportionately impacting Black, Indigenous, and poor people, the common threads of racial and economic oppression become starkly apparent. A kind of planetary suffocation engendered by longstanding extractive and dispossessive forces predated the “pathogenic period” of the pandemic, generating an ecological precariousness that began “by tak-

23 Simard and Vyse, “Mycorrhizal Networks.”

24 Achille Mbembe, “The Universal Right to Breathe,” trans. Carolyn Shread, *Critical Inquiry*, April 13, 2020, <https://critinq.wordpress.com/2020/04/13/the-universal-right-to-breathe/>.

25 Ibid.

ing away breath” and condemning most of humankind to the “premature cessation of breathing.”<sup>26</sup> While Mbembe draws on the suffocating neocolonial practices that render breath precarious for many people in the Global South, Sefanit Habtom and Megan Scribe address how “settler atmospherics”<sup>27</sup> inhibit breath for Black and Indigenous peoples in white supremacist settler states. They suggest “co-breathing,” building relationships as co-conspirators to challenge the “supposedly natural violence found in settler colonialism and anti-[B]lackness.”<sup>28</sup>

Thinking with forests and the symbiotic processes they foster hold important lessons for inculcating an ethos of reciprocity: “Humankind and biosphere are one.”<sup>29</sup> Indigenous thinkers across many cultures and philosophies have long been attuned to the multitudinous relations within forests as sources of law and as teachers in living well with others. Kimmerer, whose work has informed and inspired our thinking, weaves together teachings from pecan groves, sweetgrass, strawberries, and mushrooms alongside the stories of her family and her people. What might appear as ontological claims emerge from material ecologies and stories of the way her and her people’s lives have been shaped by abundance, mutual cooperation, and joy but also by colonial violence and dispossession. Indebted to such forms of bio-cultural knowledge, recent scholarship has focused on the life of forests as multispecies ecologies<sup>30</sup> and explored sylvan semiotics and communication.<sup>31</sup> Attending to forests in these ways invites us not only to see them as photosynthesizing

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26 Ibid.

27 Kristen Simmons, “Settler Atmospherics,” *Society for Cultural Anthropology*, November 20, 2017, <https://culanth.org/fieldsights/settler-atmospherics>.

28 Sefanit Habtom and Megan Scribe, “To Breathe Together: Co-conspirators for Decolonial Futures,” *Yellowhead Institute*, June 2, 2020, <https://yellowheadinstitute.org/2020/06/02/to-breathe-together/>.

29 Mbembe, “The Universal Right to Breathe.”

30 Tsing, *The Mushroom at the End of the World*.

31 Eduardo Kohn, *How Forests Think: Toward an Anthropology beyond the Human* (Berkeley: University of California Press, 2013).





*Fig. 2.* Nurse log on the Big Tree Trail, Wah'nah'juss Hilt'h'hoiiss (Meares Island, so-called British Columbia). Photo by Ayesha Vemuri.

sinks for carbon, but as participants in interspecies networks of microbial and macro-biotic life that co-constitute one another.

From different paths and places, both of us have found ourselves as settlers and visitors in the forests of the northern Pacific coastal region.<sup>32</sup> Forests' diversity and density stem from evolutionary adaptation and symbiotic growth. In these temperate forests, cycles of life, death and decay, mycelial soil networks, and salmon runs, have generated complex ecosystems over millennia. They have also been sites of change and intervention

32 I (Ayesha) am an immigrant/settler of color who lived and studied for many years in so-called Portland, Oregon, which rests on the traditional village sites of the Multnomah, Kathlamet, Clackamas, Chinook, Tualatin Kalapuya, Molalla, and many other tribes who made their homes along the Columbia River. I (Hannah) am a settler who grew up on Lək'wəḡən and W̓sáneć territories in Victoria, and the coastal forests in the shared, asserted, and unceded territory of the Penelakut, Lamalcha and other Hul'q'umi'num-speaking peoples on Galiano Island. Both of us currently live and work on the territories of the Kanien'kehà:ka Nation in Tiohtià:ke.

wrought by both human and nonhuman forces. While settlers may have mistakenly seen these lands as uncultivated, supporting the terra nullius doctrine, they have been stewarded since time immemorial by Indigenous peoples, through various management practices including burning, harvesting, and maintenance. It is not simply ecosystems such as forests that provide services to humans, but plants and more-than-human animals depend on people for their worlds to flourish. They have co-evolved through millennia of breathing, living and flourishing together.

Thinking through solarly has turned our attention to stories that show us how solar energy conditions and moves through various forms of life in our heliocentric universe. This includes following the way that plants store, release, and make use of the sun's energy in processes that sustain us and other beings. In the contemporary moment of multiple planetary crises, following breath through forests suggests humility in recognizing the co-constitution of multispecies worlds and orients us toward forging relations of conspiracy in the face of the uneven conditions of breathability. Solar energy, reflected and absorbed by the forest canopy, is revealed not merely as a fuel for endless human consumption, but a gift that, when accepted along with a corresponding recognition and work of reciprocity and care, can enable multispecies flourishing.

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## What Fuels You?<sup>1</sup>

*Gretchen Bakke*

Are you in need of an energy transition? It's a question worth asking. After all, everything else is doing it — the power plants most especially. So many now are converts or in disuse that it can feel like a new god's been born with all new rules to the fact of the following. Sun Ra says: "The impossible attracts me, because everything possible has been done and the world didn't change."<sup>2</sup> That seems right.

The cars are threatening to do it too, this energy transition thing. Moving from the i|pow! |bang of explosions (they are small, that's why the tiny font) but there are lots of them. It should look like this: explosion explosion explosion explosion explosion explosion explosion explosion bang bang chitty chitty bang bang explosion explosion explosion explosion explosion explosion explosion explosion explosion. "That's so twentieth century," says my granddaughter one future day. She knows. We alls knows that "the age of the Internal Combustion Engine (ICE) is over. Electric cars are the future. The transition has just

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- 1 Drafted in 2018, revised during the pandemic, and finished thereafter with a tip of the hat to Karen Pinkus, *Fuel: A Speculative Dictionary* (Minneapolis: University of Minnesota Press, 2016).
  - 2 Sun Ra, *The Immeasurable Equation: The Collected Poetry and Prose*, eds. James Wolf and Hartmut Geerkin (Waitawhile: Enterplanetary Concepts, 2005), 457.

begun...,” or so says Forbes in 2018.<sup>3</sup> Would that this were the only ICE to melt from our world, this newly acronymed engine that we used to just call an engine. And by used to, I mean, like last week or maybe just yesterday. But past is past.

And what about you? Are you still powering forward, aiming for maximum productivity, maximum output, the slim tight efficiency of the neoliberal businessman? Do you fly to meetings in an airplane? That’s so **kerosene** of you? Do you work on that plane instead of watching *X-Men XIV: Climate Apocalypse* and missing most of details because those teeny tiny ear buds don’t really work that well? That’s a bit more **biomass**. You are still on a plane after all traveling to a meeting after all, but at least you can contrive to squander some of your time along the way. Or perhaps you are homeofficing your way to that meeting now, your eyes turned to saucers of Zoom. **Coal**. You. Inert desk chair bound until burned. And burn you do. All those tiny squares of Zoom = a hundred thousand pounds of coal a day. Plus, one pound to make your new reading glasses, cuz your eyes are seriously shot. It’s a one-to-one material, coal is. Burn a pound of it and get pound of carbon dioxide. At least the math is easy. Take a deep breath; its warmer already.

Breathing.

Breathing with others.

Remember?

The color beige.

Generic corporate spaces.

Remember?

Plastic tables that look like wood.

Remember?

Remember the world economy and being a part of it. Remember **Money**. Profits. Bottom lines. Is **desire** what fuels you? A desire for more. prestige, publications, shoes, sex, money,

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3 Tom Raftery, “Seven Reasons Why The Internal Combustion Engine Is a Dead Man Walking [Updated],” *Forbes*, September 6, 2018, <https://www.forbes.com/sites/sap/2018/09/06/seven-reasons-why-the-internal-combustion-engine-is-a-dead-man-walking-updated/>.

thread counts, miles this month. More. When more is what you pour in your tank, desire's what cranks your drive. If it's goin' up it's gettin' better. "Don't stop believing," says Journey, mediocre band. Just "get on the midnight train goin' anywhere." There's a thought. When this derailment is past, consider the journey and take the train, but please avoid the night train; that would be you just trying to **petroleum** the fuck out of a low carbon lifestyle, sleeping on a train like that so you can work all day and then work all the next day as if you are on a plane, but more exhausting. Instead take a day train and add a day to get there — wherever it is you are going — and add an extra night in a hotel, sleep in a comfy bed not a berth, and don't work at all. Now you are starting to get somewhere. That's almost **solar** of you. Bringing your efficiency down to 22% or so. **Solar thermal** is a bit higher, if you really want to keep one claw in the modern. And once you get there to that place wherever you're going, but not on an airplane this time, and you've stopped zoom zoom zooming don't bother to charge your phonetabletcomputere-bookcigarette, instead how about a walk? Where are you in anyway? How does it smell there? Is it all **diesel** stink and speed? That's one way to be, or one way to avoid being. Do they drink this there? The **Mauresque**. Meaning "of inspiration by African kings." Invented to be "consumed by female drinkers who find Pastis a little too strong."<sup>4</sup> Really, the Mauresque is the theme drink of the energy transition. Nothing too strong. The female is future inspired by African kings and all that **jazz**.

Anyway, if they drink that there, where you're spending an extra night in a hotel because you didn't fly to that meeting, you should probably drink it too. Not too much though because **alcohol**'s a fuel too, but if that's what fuels you, you'll find things go poorly over the long term. Solar really is the way

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4 One part Pastis (1.5 oz.), one part Orgeot (almond syrup, 1.5 oz.), 1 to 2 ice cubes depending on the heat of the day. Cold water, to taste. I recommend carbonated water. Recipe from experience; history from "Mauresque," *Social and Cocktail*, n.d., <https://www.socialandcocktail.co.uk/cocktails/mauresque/>.



*Fig. 1. Petrocapitalchinoism, Shell cafeteria fancy drinks station, Houston, TX. Photo used with permission.*

to go, and the math on it is easy: 22% efficiency. If you are **coal**, let's say you are (Zoom Zoom Zoom) your normal efficiency is 37%—though you can co-gen on up to 67% or so—that's writing emails at 10:30 PM pestering your colleagues, who've gone **hydro** and have their feet up with a good novel by then. Forget about it. You're like a petrochemical company rolled up in human form, maximizing bang for buck. If you are thinking seriously about an energy transition, then you have to turn some things on their heads. Like all that efficiency, like more is more, like publish or perish.

So check your productivity level, are you learning to do less with more, taking the lesson of the solar panel and putting about 22% percent of your potential energy to good use and then just hanging out and taking long naps on the lawn? Or, if you must, you can go all Marx on yourself and “do one thing today and another tomorrow, [...] hunt in the morning, fish in the afternoon, rear [sheep] in the evening, criticise after dinner [...]



without ever becoming hunter, fisherman, herdsman or critic.”<sup>5</sup> Add in some time for watching cat videos on the internet, and it’s not half bad as far as energy transitions go. Plus, you’ll need those sheep to keep the lawn shorn<sup>6</sup> because otherwise its back to the scythe, and nobody really wants to transition quite all the way back to age of muscle, analog **metabolism**. That’s you, a hierarchically inclined hunk of meat with an obsessive attachment to semiotic systems; you, slightly more energy efficient than a sheep and slightly less so than a kestrel.<sup>7</sup> Figure it at 70 calories for kilo of body weight and even you can do the math on you. “Food is fuel.” “You are what you eat.” Platitudes platitudes. “When you think of a leaf, you use the energy of a leaf,” that’s more like it. Howard said that, as he wandered past us at the breakfast buffet, ignoring the forever-temptation of the **waffle** station. Instead, his eyes captivated by the dust caught in the sharp light of morning. “Merely a mote [...] suspended in a sunbeam.” Carl Sagan said that, speaking the earth, you’ve heard of him.<sup>8</sup> But here it’s Howard the mote, with no fame to claim. Later, I saw him disappear. Consumed by the forest as he past. I remember.

A leaf doesn’t need an energy transition; it is an energy transition, forever knitting itself into existence from sunlight, H<sub>2</sub>O, and CO<sub>2</sub>. **Photosynthesis**. Until we eat it. Energy transition. Potato chips? Leaf. Blueberries? Leaf. Idea of a leaf? Leaf. It’s all leaf leaf leaf all the way down. Even **gasoline**, it’s just a very

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5 Karl Marx and Friedrich Engels, *The German Ideology*, ed. C.J. Arthur (New York: International Publisher, 2004), 53.

6 Alex Blumberg and Kendra Pierre-Louis, “Sheep + Solar, A Love Story,” in *How to Save a Planet*, produced by Kendra Pierre-Louis, Rachel Waldholz, Anna Ladd, Daniel Ackerman, and Hannah Chinn, podcast, October 21, 2021, <https://gimletmedia.com/shows/howtosaveplanet/39hgkba/sheep-solar-a-love-story>.

7 Blaxter “reported that F [Basal metabolism] in sheep was below the interspecies mean; in cattle it was above,” quoted in A.J.F. Webster, “The Energetic Efficiency of Metabolism,” *Proceedings of the Nutrition Society* 40, no. 1 (1981): 122.

8 Carl Sagan, *Pale Blue Dot: A Vision of the Human Future in Space* (New York: Random House, 1994), 6.

old leaf. And what is a leaf (when compared to beef)? It's pretty much the least efficient thing on earth, that's what it is: 3% of the potential energy in a ray of sunshine becomes plant. The rest is just there for the pleasure of it.

Bask in that; 97% inefficient and the origin of the world. Caused our good Bataille a conniption. After all, what to do with all the excess granted to us by the sun?<sup>9</sup> War, the status quo while an effective way to waste what we got, was not, he felt, the best possible approach the endless creeping increase of leaf-sunshine relations. How about a romp in the bushes, he suggested? Blow off steam. The turbulence of the bull. \*Wham\*\*\*Bam\*\*\*Thank you Man\*. Follow that advice and before you know it you're pressed up against a world population of 7.7 billion. Fewer now of course, corona non-negligible, but still six billion more than 1859 when we figured out how to drill up rock oil from underground and burn it; seven billion more than way back before coal came into vogue.

**Fossils**, that's what fuels you. Its 5:45am and you're on the tread mill working off that bottom line. Breathing. Remember? Just open your mouth, and blow. That's all it takes: 25 sextillion molecules come hurtling out of you and into him and her and them. The others. The company. **Lust**. We thought it was ideas we were exchanging when once we flew to meet in no-Zoom rooms, but really it was ourselves. Weep with it; molecular love.

Or perhaps upon waking reorient. Perhaps to dream. Said Shakespeare, overachieving bastard. Adore him, but don't emulate. Instead, upon waking, reorient. Work hard to accomplish a fraction of what you did last year, or yesterday, or this morning. That's **solarity**; breath it in. Then. Don't work hard, just roll. Like a 5 year old rolls down a perfect hill. Leaves cling to hair, sheep on her lawn. A tick or two. **Gravity**. And when the dizzy stops, look up. You can see the creatures of this world and those not of it in the clouds drifting by. No need to be too cirrus on this day, a-cumulous they climb to the heavens. No need to take that

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9 Georges Bataille, *The Accursed Share*, vol. I: *Consumption*, trans. Robert Hurley (New York: Zone, 1991).



*Fig. 2. Cloud Rhino Surfs into Twilight. Photo by the author.*

stairway too; just watch. See. They them there in their world.  
You in yours. The ras of the sun. Reorient.

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It's impossible to confuse a sunflower, did you know that? There was a scientist (running on diesel) who snuck up on them and turned them around during the night (her flowers were in plant pots) but lo' and behold, when the new day dawned their heads were facing back east; they knew even as we don't how to follow the light of the day.

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## A Politics of Solar Abundance

*Cara New Daggett*

The destruction endemic to fossil fuels is not without its pleasures. Many of us, and not just the privileged, have become accustomed to thinking about our desires in terms of what is made possible by fossil fuels. That is why the abolition of fossil fuels requires not only new fuels to plug into existing pleasures, but new subjectivities, desiring different energetic relations. An inversion of fossil life will demand that those of us who extract from an imagined world of scarcity become attuned to the ethical responsibilities of energy abundance. It will require the conversion of petropeople into solar subjects.

Becoming solar is different from plugging solar panels into the status quo. Becoming solar subjects, and not just consumers of solar energy, means nurturing solarity as a way of life, a geothology, a system of values that transforms desires. Theology might seem an odd emphasis for understanding modern fuel. However, in studying the history of energy, I have come to appreciate that fossil fuels have a strong cosmological dimension that helps explain their grip on contemporary life.

Fossil fuels feed modern conceptions of the sacred, what I have elsewhere described as a “geothology” of energy, a theol-

ogy dusted in coal ash.<sup>1</sup> Energy is not a timeless concept, and it had no scientific meaning prior to nineteenth-century efforts to make coal-fired engines more efficient. The resulting science of thermodynamics served as a basis for a dominant logic of energy, which married the Anglo-Protestant mania for work and thrift with an imperialist drive to put the world to work for Western profit. This was not the only possible interpretation of thermodynamics, although it remains a dominant one.

The fossil sacred is work, and its evil is entropy. This is a particular kind of work, one that moves matter in support of extractive capital. Meanwhile, entropy, the second law of thermodynamics, describes the underbelly of energy. It says that energy tends to dissipate into forms that cannot do work. Entropy, categorized as waste, haunts human efforts. Things fall apart; perpetual motion is impossible; inertia drags. Nature appears to be against us, or at least against efficient work. Work orients what petropeople are encouraged to desire — mass consumption that thumbs its nose at scarcity — while rationalizing the pain and violence of fossil capital as sacrificial, as serving the greater glory of putting the world to work in the name of mastering it.

This helps explain the urgency with which petrocultures extract and accumulate energy. It arises from the twin assumptions that energy is both scarce and recalcitrant, always getting lost to dissipation. There are racial and gendered relations at play here, in the demonization of “dull, feminized matter,” chaotic and awaiting the push into ordered motion.<sup>2</sup> Racial categorization relies upon such geological judgments, Kathryn Yusoff writes, that divide “matter (corporeal and mineralogical) into active and inert. Extractable matter must be both passive (awaiting extraction and possessing of properties) and able to

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1 Cara Daggett, *The Birth of Energy: Fossil Fuels, Thermodynamics, and the Politics of Work* (Durham: Duke University Press, 2019).

2 *Ibid.*, 75. See also Bruce Clarke, *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics* (Ann Arbor: University of Michigan Press, 2001), 42.

be activated through the mastery of white men.”<sup>3</sup> The evil of waste, stasis, and indolence, must be overcome, not just locally, but cosmically, to glean more from the sun’s dissipation. Waste must be overcome not because it gets in the way of survival, but because waste stands for the nature that exceeds human control, for all that the sun fritters away when it promises such an amassing of motive power.

It may be strange to think of fossil theology as engaged in a struggle against entropy when massive waste is its byproduct, and wasteful consumption is its lodestar. But fossil theology, and its underlying thermodynamic logic, are aware that increasing the fervor of industrial activity will inevitably increase waste. Nature’s sins are always with us. It is not about avoiding waste per se, but of capturing as much energy expenditure as possible. For fossil theology, this only underlines the importance of an ever more vigorous exertion of masculinized order: accounting, surveillance, treatment, discarding into sacrificial zones.

### “Be Like the Sun!”

Political struggles against fossil fuels will need to engage with its theological dimensions and disrupt the affective charge of its value system. Solarity is particularly well suited as a political-theological strategy because it neatly reverses fossil values. Indeed, the sun is a reminder of natural sin for petrocultures, in that it offers itself abundantly with no concern for efficient outcomes. Much of the energy created by its conflagrations radiates into the cold surround of space, with little discernible effect, at least to humans. From the perspective of petrocultures, it is only thanks to creatures on Earth, who receive tiny amounts of that energy and put it to work, that anything seems to happen at all. And although the sun offers an abundance of terrific force each day, our ability to accumulate or hoard it is limited when compared to fossil fuels. Neither can solar energy be made arti-

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3 Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018), 2–3.

ficially scarce, stymying the primary avenue for profit-making in fossil capital systems. Finally, the sun is emblematic of natural decay, of a mortal style of divinity. For although the sun feeds a glorious explosion of life, dissipation overrides it and, like us, the sun will die.

And so, while fossil theology is rooted in work and extraction, urgently pursued against the twin threats of scarcity and dissipation, the sun gives us an entirely different model. The iconoclastic theorist Georges Bataille proposed just such a “general economy” based upon a heliocentric reading of energy, arguing that the sun shows how energy abundance, and not scarcity, best characterizes the cosmic exchanges that comprise life and death. According to Bataille, the narrower economics of capitalism are based upon the unfounded assumption of resource scarcity, which animate the drive to accumulation, competition, and unlimited growth. But the perception of scarcity is only ever a local one. A cosmic perspective reveals that energy is always in excess of what can be used toward growth, which will face geographical, and not energetic, limits. Energy excess is the ontological truth of the universe. Bataille’s general economy takes this cosmic view, inspired by the sun’s expenditure, in excess and “without any return. The sun gives without ever receiving.”<sup>4</sup>

A cosmology of abundance finds ultimate meaning in expenditure, rather than production. Bataille’s general economy presents giving as a rational response to the dangers of energy excess. While production can expand in certain contexts, once the limits of growth are reached, the energy excess “must necessarily be lost without profit; it must be spent, willingly or not, gloriously or catastrophically.”<sup>5</sup> New technology might offer expanded opportunities for growth, but it, too, eventually meets limits. Industrial forces have only intensified the energy surplus that accumulates, such that “henceforth what matters primarily

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4 Georges Bataille, *The Accursed Share*, vol. I: *Consumption*, trans. Robert Hurley (New York: Zone Books, 1988), 28.

5 *Ibid.*, 21.



is no longer to develop the productive forces but to spend their products sumptuously.”<sup>6</sup>

Energy becomes political to the extent that it poses problems for a public. If energy is understood to be fundamentally abundant rather than scarce, then its politics would shift dramatically in response to a different set of problems. Instead of fossil capital, whose problem is to find ever more energy to accumulate, a politics of expenditure confronts the potential perils of energy excess. The more energy that builds up in time and space, the more that excess poses an existential threat. Bataille argues that, because energy “cannot accumulate limitlessly in the productive forces,” it is bound to escape and be spent, “uselessly” or lavishly.<sup>7</sup> Humans have some limited ability to “choose an exudation that might suit us,” but if they fail to manage the excess, war and other “catastrophic expenditures” become more likely, as especially effective means for burning through a massive energy stockpile.<sup>8</sup> This is why a politics of expenditure would both seek to avoid a dangerous build-up of energy, while continually giving away energy abundance in ways that promote multispecies thriving.

Whatever we make of the material claims of Bataille’s notion of excess, as a political orientation, his calls for expenditure can feel off-putting to readers worried about wanton fossil-fueled consumption and the need to recognize limits. Indeed, the problem we confront today seems to be excess, excess everywhere, and not a limit in sight—to the moon and Mars and beyond with Tesla trucks, if needs must. Scarcity is still relevant, of course, but it is too often treated as a challenge for technology to overcome. And so, environmentalists are led to take up the call for limits and conservation as the logical counterargument to late modern capitalism.

However, it is solar abundance, and not anemic calls for reduction, that is best equipped to counter the cruel pleasures

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6 *Ibid.*, 36.

7 *Ibid.*, 23.

8 *Ibid.*, 23–24.

of fossil-fueled life. Abundance has more than tactical advantages. It confronts petrocultures on the terrain of the sacred. There is an aesthetic and ethical chasm between an approach that calls for energy limits, for giving things up, and one that proclaims energy abundance. The ascetic approach finds morality in foregoing energy expenditure, while the other encourages the development of better spending and giving. Both involve limits, and both would likely result in overall reductions in energy use, but in worlds of abundance, the goal is to limit dangerous accumulation, and to appreciate how cooperative spending leads to more wellbeing, rather than to demonize consumption itself. In this sense, Allan Stoekl, a close reader of Bataille, shows how Bataille's notion of expenditure can function as the door through which we arrive at a respect for limits, because limits become merely the means to ensure the continual possibility of spending.<sup>9</sup> Oxana Timofeeva interprets it as, "*Be like the sun!* — this is basically a Bataillean motto for the possible future of the political economy adjusted to the planetary scale and balanced with the ecological whole."<sup>10</sup> Be like the sun, rising each day to give without return.

### A Political Economy of Abundance

In terms of a political strategy that could undermine extraction, solarity suggests paying attention to expenditure, to giving without reference to utility. Fortunately, as Bataille also recognized, solarities do not need to be invented, and contrary to Bataille's focus on premodern gift economies, they are not confined to the distant past. Biologist Robin Wall Kimmerer, a member of the Citizen Potawatomi Nation, provides important ethical and scientific arguments for an "economy of abundance" that are

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9 Allan Stoekl, "Excess and Depletion: Bataille's Surprisingly Ethical Model of Expenditure," in *Reading Bataille Now*, ed. Shannon Winnubst (Bloomington: Indiana University Press, 2007), 265.

10 Oxana Timofeeva, "From the Quarantine to the General Strike: On Bataille's Political Economy," *Stasis* 9, no. 1 (2020): 154.

somewhat lacking in Bataille's more speculative odes to solar abundance.

Kimmerer encourages us to derive economic lessons from plants such as serviceberries or Saskatoon trees that “transmute these gifts [light, air, water] into leaves and flowers and fruits. They store some energy as sugars in the making of their own bodies, but much of it is shared.”<sup>11</sup> In this economic model, “wealth means having enough to share.” Energy is still the currency, as it is in fossil capital, but abundant energy is circulated rather than hoarded. Exchanges are

based upon reciprocity rather than accumulation, where wealth and security come from the quality of your relationships, not from the illusion of self-sufficiency. ... Even if [Serviceberries] hoarded abundance, perching atop the wealth ladder, they would not save themselves from the fate of extinction if their partners did not share in that abundance. Hoarding won't save us either. All flourishing is mutual.<sup>12</sup>

An economy of abundance recognizes that thriving multispecies worlds, which make human life possible, are constituted by entangled reciprocities of giving and receiving excess energy.

This contradicts the reigning evolutionary paradigm, which assumes that the primary driving force of evolution is the struggle over scarce resources. Kimmerer draws upon long-standing Indigenous knowledge, as well as more recent critical voices in evolutionary biology, to argue that the scarcity paradigm is “fiction.” Scarcity arises in certain contexts, of course, but Kimmerer also emphasizes how capitalism depends upon manufacturing artificial scarcity to make a profit. Ironically, she observes that, as a result of capital accumulation and mass consumerism, genuine scarcity becomes more common and intense.<sup>13</sup> In this

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11 Robin Wall Kimmerer, “The Serviceberry: An Economy of Abundance,” *Emergence Magazine* 9 (December 2020), <https://emergencemagazine.org/essay/the-serviceberry/>.

12 *Ibid.*

13 *Ibid.*

way, both Bataille and Kimmerer help us to understand how excess can be truly dangerous. Giving away abundant energy is not only ethical, but ecologically advantageous.

While economies of abundance can be nurtured at local and regional levels, there are likewise transnational policies that would help enact a shift from petrocultures, anxious about energy scarcity, to solar cultures that take seriously the responsibilities of abundance. In the North, this would include safely redistributing the dangerous excesses that are hoarded here and switching the focus from private extraction to public spending. Bataille proposes massive transfers of wealth from North to South, a cancellation of debts, as one way to depressurize the built-up energy.<sup>14</sup> More specifically, and parochially, it might mean, in the halls of the United States Congress, the rechanneling of defense spending toward public health, education, the building of sumptuous communal spaces, and yes, solar panels and grids, but developed with collective flourishing in mind, and not growth-at-all-costs. After all, as David Schwartzmann argues in his call for “solar communism,” the military-industrial complex is one of the main culprits in climate change, and it has been largely ignored by climate justice movements, and by many Green New Deal proposals.<sup>15</sup>

Of course, Schwartzmann does not need the notion of a solar sacred to advance these critiques. And, indeed, Timofeeva points out that Bataille’s solar economic proposals are totally incompatible with global capitalism and would require a revolutionary politics that remains underdeveloped in Bataille’s writing.<sup>16</sup> Nevertheless, where the solar sacred is helpful to eco-Marxist politics, and arguably indispensable for countering petrocultures, is in the fraught question of how to mobilize petropeoples, of how to “convince a planet of demi-gods and gods, and creatures even

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14 Bataille, *The Accursed Share*, 39–40.

15 David Schwartzmann, “Beyond Eco-catastrophism: The Conditions for Solar Communism,” in *Socialist Register 2017: Rethinking Revolution*, eds. Leo Panitch and Greg Albo (New York: Monthly Review Press, 2016), 143–60.

16 Timofeeva, “From the Quarantine,” 154–55.

greater than gods, that they want to be mortals. And specific kinds of mortals: ones who know the attractions and powers of having once been deities.”<sup>17</sup>

Petrodemigods are slowly remembering that the sun is a deity, too, and it is a frightful one to cross. Petropeople like me, whose ancestors willfully ended so many other lifeworlds through extraction and possession, are now cowering with other Earthlings under the excess heat of solar radiation, trapped under an atmospheric quilt thickened by fossil fuel emissions. Kimmerer tells us that “[I]ndigenous story traditions are full of these cautionary teachings. When the gift is dishonored, the outcome is always material as well as spiritual.”<sup>18</sup> Petropeople now fear the kinds of dystopian conditions that Indigenous peoples have already endured for centuries, as Kyle Powys Whyte, another prominent Potawatomi scholar, observes.<sup>19</sup> Petropeople live in “worlds their ancestors would have fantasized about,”<sup>20</sup> and the looming climate crisis is as much about the end of that fantasy world as it is about the loss of the World more broadly.

That is why the death of the fossil God/Man, that dream of vanquishing entropy and harnessing the entire sun, will require more than affixing solar panels to the roof of communism. Bataille gives us ideas for converting fossil demigods, which, as the rise of far-right reactionary movements reminds us, include more than elite capitalists, pointing out that “to solve political problems becomes difficult for those who allow anxiety alone to pose them. It is necessary for anxiety to pose them. But their solution demands at a certain point the removal of this anxiety.”<sup>21</sup> Conservation, metering, measuring our footprints, reducing our consumption: these are anxious behaviors, and

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17 Jeff Diamanti and Imre Szeman, “Nine Principles for a Critical Theory of Energy,” *Polygraph Journal* 28 (August 2020): 143.

18 Kimmerer, “The Serviceberry.”

19 Kyle Powys Whyte, “Indigenous Science (Fiction) for the Anthropocene: Ancestral Dystopias and Fantasies of Climate Change Crises,” *Environment and Planning E: Nature and Space* 1, nos. 1-2 (2018): 226.

20 *Ibid.*, 225.

21 Bataille, *The Accursed Share*, 14.

still posed by fossil subjects, primed to experience the end of our fossil fantasy world as primarily a loss. It will be mostly a loss for a small number of fossil elites, to be sure, but there are more people, like me, who are complicit in and hurt by fossil violence, who derive both privileges and pain from it. A politics oriented around solar abundance would mean a better world for most.

The pursuit of solarity as a political theology can help to reframe the abolition of fossil fuels in the West, not as the relinquishment of the power of demigods, but as the pursuit of a different kind of glory, and a different kind of pleasure. And not in the name of sustainability or labor itself, as if the goal of subsistence could ever provide enough aesthetic resources to convene a mass desiring-machine, but to spend energetic abundance better, more sumptuously, as gifts without return, with a luxurious, “wild exuberance”<sup>22</sup> that sustains communal wealth and beauty. In Timofeeva’s vision, “nonproductive expenditure must be taken seriously and organized as a conscious politics of gifts without reciprocation—a glorious politics.”<sup>23</sup> In this, it is clear that solarity extends far beyond solar panels and the grid, and into the entire sociotechnical system of how energy gets spent. Whereas fossil theology demands extraction as its sacrifice, including extracting from our labor, our creativity, and our communities, solarity at least allows petropeoples to ask the right question: how can we spend energy better?

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22 Ibid., 33.

23 Timofeeva, “From the Quarantine,” 155.

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## Exposure

*Jason De León*

The cramped room's only window is the size of a porthole and relatively useless. It's hidden behind a dirty blanket that guards against any hope of natural light or fresh air. On the outside, the glass is fortified with rusting metal bars. The curtain keeps out the prying eyes of nosey neighbors and immigration agents. The bars remind you that you aren't free to leave, at least not until your family Western Unions more money to your smuggler.

The bare bulb hanging from the ceiling has become your sun and moon. Hours, days, and weeks are increasingly illogical ways to measure your forward progress north. Honduras to Houston in only two to six months for the bargain price of around 10,000 USD.

The bustling life of Mexico City carries on outside while a half-dozen migrants and their smugglers create a world behind closed doors devoid of clocks, calendars, or sunlight. Waiting and hiding is a way of life. All you can do is stay occupied while time laughs.



Fig. 1. Migrant Safe House, Lechería, Mexico City. Camera: Nikon F3. Film: Kodak Tri-X 400. ISO: 3200 (pushed 4 stops). Aperture: 1.2. Shutter Speed:  $\frac{1}{50}$ . Photograph by the author.

You eventually emerge from prolonged darkness only to be thrust into the killing heat<sup>1</sup> of the Sonoran Desert where at least 4,024<sup>2</sup> migrants have died since the 1990s from hyperthermia, dehydration, and the many other complications that result from prolonged exposure to the sun. These deaths are the direct result of the 1994 United States border policy known as “Prevention Through Deterrence,” a strategy that uses security infrastructure to funnel migrants toward remote areas in the hope that extreme temperatures and rugged terrain will be impediments to human movement.<sup>3</sup> In the Sonoran Desert, the sun is the US Border Patrol’s primary weapon.

Undocumented migration is a life lived in shadows, a constant negotiation with metaphorical and literal exposure.

1 Alex Nading, “Heat,” *Society for Cultural Anthropology*, April 6, 2016, <https://culanth.org/fieldsights/heat>.

2 “Arizona OpenGIS Initiative for Deceased Migrants,” *Humaneborders.info*, n.d., <https://humaneborders.info/>.

3 Jason De León, *The Land of Open Graves: Living and Dying on the Migrant Trail* (Berkeley: University of California Press, 2015).



*Fig. 2.* Memo resting in the shade. Sonoran Desert, July 2009. Kodak disposable 35mm camera. Photograph taken by Lucho.

### Exposure Triangle

Making photographic images is about finding<sup>4</sup> and dealing with light. You cannot take a picture without some bit of electromagnetic illumination capable of eliciting a response from a roll of analog film or a digital camera's sensor. Once a photographer finds a usable moment of light, she must negotiate with it so that a legible image can be produced. This negotiation is based on the balance of three variables — aperture, shutter speed, and ISO<sup>5</sup> — that form the basis of what is called the “exposure triangle.”

As a camera-wielding anthropologist committed to making visible the humanity and brutality of the migration experience,

4 “Finding” assumes you are not producing your own light with a flash.

5 ISO stands for International Organization for Standardization, an organization that sets the technological and product standards globally. However, ISO in relation to cameras refers to either a film's sensitivity or the sensitivity of a digital sensor.



Fig. 3. Preparing lunch on the Central American Migrant Trail, Chiapas, Mexico, 2015. Camera: Nikon F3. Film: Kodak Ultramax. ISO: 400. Aperture:  $f/8$ . Shutter Speed:  $\frac{1}{60}$ . Photograph by the author.

I chase light and wrestle with the exposure triangle so that I can make what John Szarkowski would call a “lively” image,<sup>6</sup> a picture that has the potential to expose new ways of seeing difficult-to-access worlds. However, the process of image making is not simply a matter of balancing camera settings. Nor is it as apolitical as Szarkowski would have us believe.

Anthropologists can’t ignore the fact that the images we make of people, just like the ethnographies we write about them,<sup>7</sup> expose elements of ourselves. This includes how we frame our practice and the corporeal relationships we have with our subjects.<sup>8</sup> In the context of migration, photographic practice is both a technological negotiation with essential light and an ethical struggle with an elemental form of nature that can and does kill

6 John Szarkowski, *The Photographer’s Eye* (New York: Museum of Modern Art, 1966).

7 Timothy Pachirat, *Among Wolves: Ethnography and the Immersive Study of Power* (London: Routledge, 2018).

8 David MacDougall, *The Corporeal Image: Film, Ethnography, and the Senses* (Princeton: Princeton University Press, 2005).



*Fig. 4.* Migrant Safe House, Lechería, Mexico City. Camera: Nikon F3. Film: Kodak Tri-X 400. ISO: 3200 (pushed 4 stops). Aperture: 1.4. Shutter Speed:  $\frac{1}{60}$ . Photograph by the author.

people daily. There is perhaps much to be gained by thinking about the mechanics of picture making as part of the ethnographic encounter.

### Aperture

The hole in a camera lens that allows light to pass through it is called the aperture. It's often adjustable so that you can make it bigger or smaller to let in more or less light. In addition, aperture size impacts an image's depth of field, that is, how much is in focus. A large aperture gives you a blurred background. A small aperture gives you sharp focus from the foreground to the distant horizon.

Ethnography, like aperture, vacillates between constructing an up-close look at an individual's experience and bringing into focus the background forces that influence their existence. Unlike most photography though, the relationship between foreground and background is not so simple. Ethnography ben-





Fig. 5. Killing time on the migrant trail, Pakal Na, Chiapas, Mexico, 2015. Camera: Fuji XT-1. ISO: 400. Aperture:  $f/5$ . Shutter Speed:  $1/150$ . Photograph by the author.

efits from (or perhaps is plagued by) our ability to use words to complicate the depth of field and its meaning. We can play with light in order to cast smugglers in shadows to protect their identity while using depth of field to contemplate the disconnect between how they view themselves and how they appear to the world.<sup>9</sup>

### Shutter Speed

An erratically moving guitar string cuts a hot cat scratch into flesh. The whirling Walkman motor sprays a fine mist of blood and computer printer ink. The left arm is chosen because the right one is covered in machete scars, a reminder of what you are running away from in Honduras.

Cameras are equipped with a shutter that opens and closes to let light enter. The length of time that light is let in is measured

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9 Also see Jason De León, *Soldiers and Kings: Survival and Hope in the World of Human Smuggling* (New York: Viking Press, 2024).

in seconds or fractions of a second (e.g., 1,  $\frac{1}{2}$ ,  $\frac{1}{250}$ , etc.). Fast shutter speeds tend to freeze motion while slow shutter speeds produce blur and convey a sense of movement.

In 2014, Mexico launched *Plan Frontera Sur*, an anti-immigration security program supported by the Obama Administration that aimed to stop the movement of people leaving Central America headed for the US–Mexico border. This policy led to an astronomical growth in immigration checkpoints, migrant detention centers, and armed guards patrolling the freight trains that migrants were accustomed to hopping on and off on as they ambled north. To avoid detection, people now walk through dense jungles where they face a combination of intense heat, exhaustion, and criminals with a propensity for kidnapping, robbery, and rape. Mexico and its natural environment have become a second border for the United States.

Pakal Na is a place many migrants refer to as *caliente*, not because the humidity averages 80 percent annually but rather as a nod to the many immigration agents, gangsters, and locals looking to exploit and profit from undocumented Central Americans passing through. Heightened security on the outskirts of town and the 100 USD head tax collected by the local chapter of MS-13 make it hard to get out of Pakal Na safely. It has become a place where a lot of waiting happens. The Sonoran Desert, where many are headed, is over 3,000 kilometers away.

Szarkowski posits that all photographs are physical records of a particular length of time.<sup>10</sup> They are also moments of captured light that sometimes illuminate pain from the past that continues to exist in the present.

## ISO

The light-gathering ability of analog film or a digital sensor in a camera is referred to as ISO. Higher ISO numbers denote a greater sensitivity to light. For example, ISO 50 film is optimized for bright sunlight while ISO 3200 film is designed for extreme

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<sup>10</sup> Szarkowski, *The Photographer's Eye*, 11.



*Fig. 6.* Still image from digital trail camera video used in forensic experiments involving pig carcasses serving as proxies for human bodies, Arivaca, Arizona, 2018. Photograph by the author.

low light conditions. Film with a low ISO (or low ISO settings on a digital camera) produce a fine grain appearance and tend to make sharper images.

Over the years, I have conducted multiple forensic experiments in the desert using pigs as proxies for humans. The goal is to make visible how migrants die and improve our understanding of how bodies decompose in this environment. Results suggest that bodies left in the desert are often quickly destroyed by weather conditions and scavengers before they can be recovered. The primary animals responsible for this destruction are turkey vultures who typically wait for a corpse to heat up and reach a particular state of decomposition before they begin feeding. Once scavenging begins, a body can be defleshed, disarticulated, and scattered far and wide in less than seventy-two hours. In this environment, the sun kills you and then cooks your body in preparation for making it disappear.

By design, migrants die in remote parts of the desert where there are no cameras or witnesses. We are not supposed to see the human costs of Prevention Through Deterrence or the desecration and disappearance of bodies. This brutality happens under bright sunlight and yet it is impossible to photograph.



## Exposure Value

Margaret Mead argues that photographs can correct the errors in observation that ethnographers are likely to commit early in their fieldwork.<sup>11</sup> According to her logic, the pictures one produces are never naïve or experienced, they are simply unadulterated snippets of real life. I disagree with Mead. Over the years, my relationship with photography has evolved and forced a constant questioning of its practice, veracity, logic, and worth. My frustrations have made me better at negotiating with available light and increased my sensitivity to the geometry of exposure and its inherent politics.

CASE NUMBER: 12-01567  
 NAME: Carmita Maricela Zhagui Pulla  
 SEX: Female  
 AGE: 30  
 REPORTING DATE: 7-2-2012  
 LOCATION: N 31.8322 W -111.278  
 CAUSE OF DEATH: Exposure  
 BODY CONDITION: Decomposed  
 POSTMORTEM INTERVAL: <1 week

We covered Maricela with this blanket and sat for hours until the Sheriff arrived and took her away. While we waited, I made a couple dozen images of her body. I didn't know what else to do with myself. Photography gave me temporary purpose. Maybe I was collecting evidence of a human rights violation. Maybe looking at her through a lens made me less sensitive to an incomprehensible reality. Camera work kept me from crying or screaming in front of my students about the world of crushing heartbreak and everyday injustice that migrants endure. It stopped me from railing against what often feels like anthropol-

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<sup>11</sup> Gerald Sullivan, *Margaret Mead, Gregory Bateson, and Highland Bali: Fieldwork Photographs of Bayung Gedé, 1936-1999* (Chicago: University of Chicago Press 1999), 4.



*Fig. 7* Sonoran Desert. Camera: Pentax 67ii. Film: Kodak Ektar 100. ISO: 125. Aperture:  $f/11$ . Shutter Speed:  $1/125$ . Photograph by the author.

ogy's futile attempts to create shared understanding and empathy. I would do those things later in private.

This photo is from January 2020. The blanket still rests in the location where Maricela exhaled her last breath. Every year I visit this spot and take this picture. I now know that it doesn't matter how many pictures of the dead we take or how in focus or well composed they are. People are still dying in the desert from hyperthermia, exposure, and whatever else nature, under the watchful eye of the us Border Patrol, can cook up. The body is gone but this landscape of violent light persists.

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## Concrete Solarities

*Cristián Simonetti*

In a 2019 interview with *The Economist* on the occasion of his 100th birthday, Nobel Prize winner famous for his Gaia Hypothesis, James Lovelock, proposed a four-point plan to save humankind from climate disaster. It is the first point I focus on here. According to Lovelock, humans should first retreat to megacities. The proposal responded largely to the 140 million people expected to migrate from their countries by 2050 as a result of climate change. In Lovelock's words: "Humans should go to megacities if they want to avoid the worst dangers of climate change. Mainly because a city is a smaller unit to control and regulate the composition of the atmosphere, the soil. Rather similar to the nests of invertebrates of various kinds: ants, wasps, bees."<sup>1</sup> Key to this proposal in an awareness foundational to the Gaia Hypothesis, wherein the earth behaves like a single complex self-regulating living entity. According to it, the soil plays

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<sup>1</sup> The full plan included in the following order: 1) "Retreat to Megacities"; 2) "Use Nuclear Energy"; 3) "Artificially Control the Earth's Temperature"; and 4) "Let Artificial Intelligence Take Over." See *The Economist*, "How to Save Humankind (According to James Lovelock)," *YouTube*, July 26, 2019, [https://www.youtube.com/watch?v=HuGjsn\\_vYz4](https://www.youtube.com/watch?v=HuGjsn_vYz4).



Fig. 1. “Without the sun there is no happiness.” Santiago residents protesting about urbanization blocking sunlight. Photograph by the author.

a crucial role in regulating the atmosphere’s composition, as plants exchange nutrients and energy across earth and sky.

Yet when considering its etymology, the word “disaster” underlying Lovelock’s proposal is a fitting term to describe how urban dwellers have increasingly found themselves. From the late-medieval Latin “*dis*” and “*astrum*,” the latter linked to the Greek term “*astron*,” the word refers to a state of disorientation resulting from a sudden disconnection from the stars. This is precisely the state in which urban dwellers in Santiago find themselves at times nowadays, as the campaign “without the sun there is no happiness” led by local residents in Santiago illustrate; residents who experience isolation from the sun as their city grows in height (fig. 1). Historically, lack of sunlight has been responsible for a number of health issues in the human populations, most notably rickets, a bone-deformation disease described initially in northern Europe by the Polish scientist Jędrzej Śniadecki at the time of the industrial revolution when buildings were increasingly constructed in close proximity, and

smoke from coal burning clouded the urban atmosphere. Diseases related to sunlight deprivation also include osteomalacia and osteoporosis in adults, as well as multiple other long-term conditions.<sup>2</sup> Understanding the relationship between sunlight and bone health spurred global campaigns in the 1930s to enrich dairy products with vitamin D. This ancient hormone has been produced for over 500 million years by some of the earliest forms of life on earth and is critical to the metabolization of calcium, affecting skeletal health in most vertebrates.<sup>3</sup>

Lovelock's proposal is paradoxical in yet more profound ways. To achieve massive urbanization cost-effectively would require the use of concrete on a scale that would obscenely exceed the current rates of production and consumption of the fastest-growing economies today. These would include China which, during the past decade, has produced and consumed in only three years more concrete than the United States has in its entire history. In its association with steel, concrete is arguably the material that has most significantly contributed to spread modernity's narrative of progress, the very same narrative signaled often as responsible for the current environmental crisis. Advancing forwards on the road of civilization, concrete has provided modernity with a solid and impermeable platform from which to transcend its rural origins while suffocating the exchange of nutrients and energy on which soil formation and plant growth, empowered by sunlight, have depended geologically.<sup>4</sup> Moreover, concrete is also a substantial contributor to global warming because the production of cement, concrete's agglutinating substance, is alone responsible for between 5 and 8 percent of global carbon emissions — figures that can increase

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2 These include multiple sclerosis, hypertension, cancer, diabetes, and depression, among others.

3 Matthias Wacker and Michael F. Holick, "Sunlight and Vitamin D: A Global Perspective for Health," *Dermato-endocrinology* 5, no. 1 (2013): 51–108.

4 Cristián Simonetti and Tim Ingold, "Ice and Concrete: Solid Fluids of Environmental Change," *Journal of Contemporary Archaeology* 5, no. 1 (2018): 19–31.

by up to 10 percent, depending on the academic source, significantly exceeding the impact of more notorious industries such as air transport.

Interestingly, despite the cosmological isolation that concrete generates as urban infrastructure rises, concrete production is silently tied to the powers of our primary star. Cement results from the burning of limestone, a sedimentary rock made of petrified shells, the appearance of which relates closely to the emergence of bones in evolution, both resulting from a sudden calcification of the oceans that occurred when calcium appeared in the fossil record. Emerging out of this calcification was the so-called Cambrian explosion, an intense diversification of life-forms out of which most animal phyla known today emerged. In burning the remaining exoskeletons of sea creatures that formerly constituted ancient, submerged reefs, urban dwellers have somewhat created their own reefs on land to protect their fragile bodies. But this has come at an extremely high prize. Not only have they deprived themselves of the exchange of nutrients and energy on which plant growth depends at the ground level, but people's relationship to the cosmos, and the sun in particular, appears increasingly abject with the rise of urban infrastructure.

Moreover, in their Prometheus efforts to emulate the powers of the sun on earth, humans have put themselves at risk from its influence by warming the planet — an influence of which life on earth, human and other-than-human, is simultaneously a product. Inside a rotary kiln at Melón, the oldest industry to produce cement in Chile, furnaces operate at around 1900° Celsius, that is, a third of the sun's surface temperature (fig. 2).<sup>5</sup> This is accomplished by burning fossilized shells with fossil fuels, both of which are nothing but fossilized sunlight. The joint calcination of these substances releases approximately a kilogram of CO<sub>2</sub> per kilogram of cement produced, contributing irrevers-

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5 To reduce carbon emissions, a recent start-up funded by Bill Gates has been unsuccessfully exploring the possibility of condensing solar light to produce cement. Daniel Oberhaus, "A Solar 'Breakthrough' Won't Solve Cement's Carbon Problem," *Wired*, November 22, 2019, <https://www.wired.com/story/a-solar-breakthrough-wont-solve-cements-carbon-problem/>.



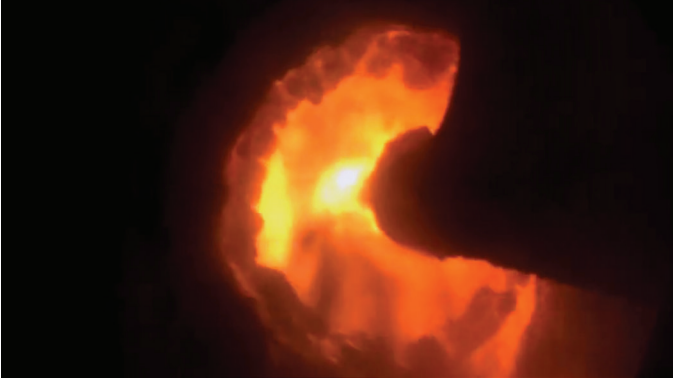


Fig. 2. Inside Melón's rotary kiln. Photograph by the author.

ibly to the acceleration of global warming through the absorption of sunlight into the atmosphere.

Reflecting on the relationship between solar energy and concrete is critical when thinking of the human condition in the Anthropocene.<sup>6</sup> With more than 50 percent of the world's population now living in cities, concrete is not only currently the most abundant building material surrounding humans but, according to many, including Lovelock, their only escape from climate disaster. Furthermore, it is also the most abundant anthropic rock ever produced in earth history, the vast surfaces of which, poured mostly over the past century, make the material a candidate to mark the stratigraphic onset of the new epoch.<sup>7</sup> Famously baptized in Victorian times by Joseph Aspidin as an "artificial rock," concrete resonates intimately with the image of an epoch defined by humanity's capacity to become a geological

6 Cristián Simonetti, "Dwelling in the Anthropocene," in *Global Changes: Ethics, Politics and Environment in the Contemporary Technological World*, eds. Luca Valera and Juan Carlos Castilla (New York: Springer Open, 2020), 141–51.

7 Colin Waters and Jan Zalasiewicz, "Concrete: The Most Abundant Novel Rock Type of the Anthropocene," in *Encyclopedia of the Anthropocene*, vol. 1: *Geologic History and Energy*, ed. Scott Elias (Amsterdam: Elsevier, 2018), 75–86.

force of planetary proportions. Natural yet cultural, geological yet social, this synthetic rock sits literally on the edge of both, especially knowing how separations between matter and spirit have been mapped traditionally in the western imagination on a division between earth and sky.<sup>8</sup> Since its modern rediscovery, enough concrete has been poured to separate momentarily the entire surface of the earth from the sky with a kilogram of concrete for every square meter.

Perhaps, after much discussion on terminology, the new epoch should be named the Concretocene, a term that can do justice both to the interests of geologists and humanities scholars involved respectively in discussions around how to date and to name the new epoch. Whereas stratigraphers have been focusing their efforts in finding a globally isochronous marker to signal the start of the new epoch, humanities scholars have been concerned with how the term masks an unequal distribution of environmental responsibility.<sup>9</sup> Concrete provides a relatively isochronous marker in geological timescales that is widely distributed and that provides a distinct cartographic clue as to who on earth is largely responsible for the environmental crisis.<sup>10</sup>

Bearing in mind the importance of concrete's use for the growth of Chile's neoliberal experiment, it is somewhat unsurprising that, since the October 18, 2019 riots, much of the discontent Santiaguino protesters have expressed has been so directly focused on upsetting this anthropic stratum. Protesters at the front lines have organized into clans, where members assume different roles in their fight against Carabineros, Chilean police forces. In charge of procuring weapons from the urban

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8 Tim Ingold, *Being Alive: Essays on Movement, Knowledge and Description* (London: Routledge, 2011), 95.

9 Andreas Malm and Alf Hornborg, "The Geology of Mankind? A Critique of the Anthropocene Narrative," *Anthropocene Review* 1, no. 1 (2014): 62–69.

10 Cristián Simonetti and Tim Ingold, "Ice and Concrete: Solid Fluids of Environmental Change," *Journal of Contemporary Archaeology* 5, no. 1 (2018): 19–31.



Fig. 3. Miner. Photograph by Laura González Márquez.

landscapes, in this case concrete stones, are so-called “miners,” whose systematic work over the months have turned Plaza de la Dignidad, the area designated as the battlefield, literally into a mining ground (fig. 3).<sup>11</sup> For many protesters this mining ground is now a symbol of a fight for social equity, as well as indigenous and environmental rights, against private interests.

11 The plaza known officially as Plaza Baquedano, site of most protests and celebrations in Santiago, was re-baptized by protesters as Plaza de la Dignidad. Magdalena Claude, “Retrato de un Clan de la Primera Línea,” *CIPER*, January 6, 2020, <https://ciperchile.cl/2020/01/06/retrato-de-un-clan-de-la-primera-linea/>.

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## Affective Energy

*Myles Lennon*

As we imagine a world beyond fossil fuels, we often dream about the sun. We fixate in particular on its capacity to generate solar electricity, declaring, for instance: “The Sun emits enough power onto Earth each second to satisfy [...] human energy demand for over two hours.”<sup>1</sup> While this sentiment is focused on the sun’s solar energy, I want to suggest that it is partly animated by the sun’s *affective* energy, the ways it “saturates the corporeal, intimate, and political performances of adjustment” that make “a shared atmosphere [...] palpable.”<sup>2</sup>

We can detect such affective energy when we bask beneath the sun’s rays or feel its warmth on our skin, as these encounters invoke a sense of something beyond ourselves, a “shared atmosphere,” one of tropical leisure or a warming planet or the sweltering discomfort of summer. This affective energy is perhaps most detectable in the sun’s visually arresting glare when it interacts with other forms of matter to produce what we com-

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- 1 Emily Kerr, “The Future of Solar Is Bright,” *Harvard University, The School of Arts and Sciences: Science in the News*, March 21, 2019, <http://sitn.hms.harvard.edu/flash/2019/future-solar-bright/>.
  - 2 Lauren Berlant, *Cruel Optimism* (Durham: Duke University Press, 2011), 16.

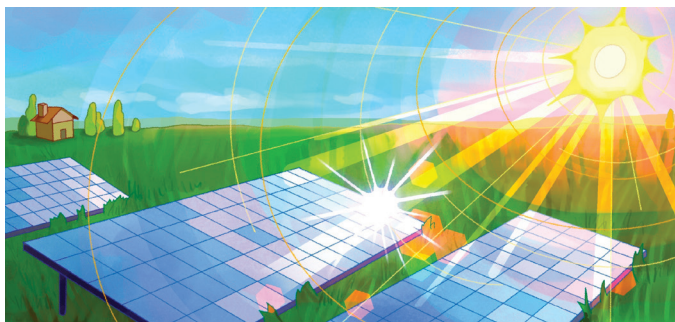


Fig. 1. Digital rendering of the shiny pastoralized solar panel. This image resembles those in the activists' PowerPoint. Image created by Cynthia Zhang.

monly call *shine*. As we will see, the captivating sight of this shine compels us to imagine the power of the sun in ways that exceed the crude distillations of megawatts and gigajoules that make palpable the nebulous idea of sustainable futures. As an anthropologist researching solar infrastructure in New York City, I found that *shine* affectively informs energy transitions from fossil fuels to renewables, enabling us to imagine, feel, and pursue the technological natures of tomorrow.

This affective energy first felt acute to me not when I was basking in the sun's rays but, instead, when I was sitting in the back of a small, poorly lit room at a community-based organization's office in Brooklyn in the company of two dozen grassroots activists from all parts of the city. Focused on bringing solar to dense urban communities, this meeting resembled similar gatherings in cities throughout the country where local leaders devise strategies to "green the ghetto" through renewable energy. Indeed, solar is often imagined as a source of "sustainability" for metropolitan spaces that have traditionally been regarded as the antithesis of nature.

The activists and I were watching a PowerPoint presentation on how solar energy works. Prepared by the community-based organization, the PowerPoint was supposed to inform local

renewable energy advocates about the specifics of solar electricity technologies and local energy policies and regulations. It consisted of several slides that visualized these technologies with hyperreal, digital images and cartoon illustrations accompanied by written information. Yet, in spite of the dense urban location of our meeting, all but one of these images showed solar farms in idealized pastoral settings rather than in city environments, and the panels shone across green, grassy fields beneath a blue sky and a bright sun without buildings or any trace of city life (fig. 1). Why would an organization based in and exclusively focused on a massive metropolis give a presentation to local activists that situates solar not in *an urban setting* but in a *pastoral* one?

This question demands we look beyond the community organization's stated purpose in preparing the presentation, that is, their interest in informing the activists. After all, PowerPoints are not just about conveying factual information, they are also about eliciting interest in a topic at hand, captivating an audience. As such, an effective PowerPoint hits certain emotional registers and subtly resonates with people's hopes, wants, fears, and dreams. A close look at the pastoral images makes evident that they were intended to do this affective work. Instead of didactically breaking down how solar infrastructure operates, these visuals were used to entice their viewers by aestheticizing the affect of the sun in several ways.

First, these images visualized shine, calling attention to the sun's glistening vitality. Literary scholar Anne Cheng aptly illuminates the affectivity of shine. She explains: "Shine offers less a description or quality of light than an active mode of relationality: a dynamic medium through which the organic and the inorganic fuse."<sup>3</sup> We can identify this "active mode of relationality" at the point in these images where the sun's rays intersect with a flat anthropogenic surface, the solar panel. This shiny intersection evinces the sort of organic-inorganic fusion that Cheng

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3 Anne Cheng, "Shine: On Race, Glamour, and the Modern," *PMLA* 126, no. 4 (2011): 1034.

describes as a biospheric phenomenon (the sun) conjoined with a manufactured energy technology. The visual simulation of the panels' shine, then, attempts to endow an electricity commodity with the feel of a natural process, the organic liveliness often attributed to the sun's rays. In other words, the images' aestheticized shine evokes conceptions of the sun as a site of nature, affectively transferring these *conceptions* onto a man-made machine.

In the process, the shine in these images accents a broader rendering of the solar panels as a naturally occurring form of life embedded in nonhuman landscapes. Consider fig. 1, which situates solar panels in a seemingly vast, unchanging field of grass beneath a sunny sky. The panels form the horizon of this pastoral scene, as if they're the natural outgrowth of the land. As the visual line between sky and ground, the panels appear like they sprouted organically from the grassy plain. Absent from this pastoral view is the host of industrialized relations that make solar panels possible: the extraction of silicon, the unhealthy labor conditions of photovoltaic production, the processing and dumping of toxic silicon tetrachloride, the panels' intercontinental fossil-fueled supply chains, and so forth.<sup>4</sup> Furthermore, no people are to be found in this image and the solar panels don't seem to be powering anything in particular. The solar technologies and the space they inhabit appear bereft of human intention or human society, a curious elision given that activists were using these images with the ultimate aim of catalyzing social movement-building in their urban communities.

The sun's shine, the panels' embeddedness in the ground, and the dearth of humans in these images work to naturalize solar energy production. Industrialized commodities appear embedded in "nature" here, distant from the anthropogenic environments of late capitalism that have made them possible. As such,

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4 Daniel Nugent and Brian Sovacool, "Assessing the Lifecycle Greenhouse Gas Emissions from Solar PV and Wind Energy: A Critical Meta-survey," *Energy Policy* 65 (February 2014): 229–44, and Ozzie Zehner, *Green Illusions: The Dirty Secrets of Clean Energy and the Future of Environmentalism* (Lincoln: University of Nebraska Press, 2012).



these images resonate with hegemonic imaginaries of nature in postindustrial cities,<sup>5</sup> attesting to the modern will to “return” to “the” land without an imprint of modernity.

At the same time, the PowerPoint’s shiny images visualize a nature imagined by a public that looks for life not only beyond the human but also *within* their anthropogenic landscape. We can detect this gaze, for instance, at Manhattanhenge, an annual event in which New Yorkers gawk at the sunset on the days in which it’s optimally aligned with Manhattan’s street grid, seeking out the vitality of the cosmos when the city skyline glistens. Such entrancement, though, is not particular to this annual event. Innumerable city dwellers every day watch the city’s skyscrapers with fascination when these towers are kissed by the sun during its descent, engrossed with their environment as the yellow orb in the sky makes their buildings shine. This affection for the sun is perhaps most legible at public protests against proposed high-rise developments focused on the obstructive shadows of luxury towers. At these events, New Yorkers literally deify the sun with Venetian masks, calling on elected officials to “save our sunlight.” Pastoral solar images seek to tap into these postindustrial relations with the sun, engendering an emotional connection between the PowerPoint’s urban audience and shiny infrastructural commodities made in China. In this way, the PowerPoint’s shine locates solar in what William Cronon calls the domesticated sublime,<sup>6</sup> an external nature that modern subjects paradoxically identify in manmade landscapes. Amidst this domesticated sublime, the sun’s affective energy blurs boundaries between the built environment and more-than-human life.

It is significant that the PowerPoint aestheticizes the sun’s affect in ways that transform solar infrastructure into a visual

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5 K. Sivaramakrishnan and Ismael Vaccaro, “Introduction: Postindustrial Natures: Hyper-mobility and Place-Attachments,” *Social Anthropology* 14, no. 3 (October 2006): 301–17.

6 William Cronon, *Uncommon Ground: Rethinking the Human Place in Nature* (New York: W.W. Norton, 1995).

trope of nature because one could deduce from its images that the panels “naturally” tap into the sun’s energy without the assistance of engineers, transnational supply chains, permits, installers, contractors, plastics, chemicals, fossil fuels, or any of the other actors and entities involved in the production of a solar farm. The aestheticized affect of the sun, then, dislocates us from the solar panels’ means of production, calling us to fetishize an industrial technology as an offshoot of the natural world. Indeed, many New Yorkers consciously subscribe to the pastoralized conception of the solar panel that these images visualize, sharing their visions of clean energy futures that align us with the trees, forests, and air. This is particularly fascinating when we consider dominant theories of commodity fetishism that suggest that commodities alienate us from nature. In these images, commodities are instead fetishized on the grounds that they can *overcome* such alienation. While solar panels and iPhones are made under comparable conditions with many of the same industrial materials, the sun enables us to see one of these as more natural than the other.

But the sun’s affective energy is not the only or even the primary reason why an urban activist might affiliate solar panels with a normative understanding of nature. As an infrastructure for reducing humans’ greenhouse gas emissions and pollution from the power sector, solar technology is an integral part of a contemporary naturalist ethos that views “the environment” as something that can be saved from the destructive impacts of fossil fuels. Solar power has long been understood as an antidote to the denigration of “the” climate and it therefore seamlessly coheres with liberal ideologies of nature that view it as external to human society. Put differently, the capacity of solar to quantifiably reduce greenhouse gas emissions has the effect of naturalizing solar technologies.

But in the PowerPoint, the panels appear not as a mitigation device to forestall humanity’s impacts on an already degraded environment. Instead, the panels appear as a part of a peaceful, pristine environment, existing and operating independently of humanity and its destructive whims. The significance of this

image, then, lies not in the fact it associates solar with a *broad* conception of external nature but, rather, in the ways it aestheticizes shine to situate an anthropogenic technology in only a particular pastoral vision. The sun's affective energy conditions this very particular erasure of the human, and solarify conspires with silicon machines in a moment of climate catastrophe to inspire an ethos of nonhuman nature.

The pastoralization of solar is by no means particular to a few activists' PowerPoint images in New York City. While city dwellers want to know and see how solar works in their dense urban environments, and while solar advocates in the city very frequently display images of solar on urban rooftops in their PowerPoints, pastoralized solar nonetheless persists in visual renderings of the "clean-energy future" that circulate in city spaces imagined to be divorced from nature and in the testimonies of people who inhabit these city spaces. When we recognize the ways in which the sun's affective energy, not just its solar energy, animate our energy politics, we can shift our efforts away from a historically violent naturalism that separates humans from "the environment" and confront the limitations of our technologies while we do the difficult work of moving beyond fossil fuels. Indeed, solar energy is a necessary improvement but not a panacea to our ills, a distinction that's easy to miss when you're entranced by the sun's shine.

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## Asolarity: Weaponized Sunlight

*Ian J. Alexander and Nicole Starosielski*

Even as it is broadcast across the planet's surface, sunlight is not an equally accessible resource. It is mediated by architectures that block solar rays. It is mediated by social practices that position some bodies in the sun, while depriving others of sunlight. It is mediated by words, sounds, and images that condition solar's material possibilities. Access to sunlight affects human and non-human organisms at the cellular and molecular levels, and deprivation of sunlight has devastating health consequences, such as impeding the body's ability to defend itself from viruses like SARS-CoV-2. Even if most phenomena are entangled with the sun, "solar media" refract these rays through a political topography, and as a result, sunlight manifests as social form.<sup>1</sup> Solar media, as we discuss here, range from buildings that amplify solar rays, to technologies such as windows that increase solar exposure, to discourses that normalize social relations with the sun.

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<sup>1</sup> For a detailed description of solar mediation and solar media, see Shane Brennan, "Practices of Sunlight: Visual and Cultural Politics of Solar Energy in the United States," PhD diss., New York University, 2017.

By paying attention to solar media, it is clear that solarity is not simply an orientation to sunpower that scaffolds biological and social growth, and it extends through numerous forms of social violence. It is weaponized in border patrol.<sup>2</sup> It is used to amplify military force. And as it illuminates film and photography, sunlight literally forms the medium of colonial and racist visibilities and photographic struggles against these visual tools of domination. This has a long history, documented in Thomas Allen Harris's film *Through a Lens Darkly: Black Photographers and the Emergence of a People* (2014) and exemplified in work like LaToya Ruby Frazier's haunting collection of photographs and reflections on her hometown of Braddock, Pennsylvania, *The Notion of Family*.<sup>3</sup> Beyond the multitude of solar violences that work via exposure and overexposure, in which available materials are often engineered to intensify solar heat in people's bodies, violence is also enacted through the asolar, the creation of social forms in which sunlight is not only absent, but blocked as a means of inflicting bodily harm and social disaggregation.

We consider one site where the asolar has long been a means of violence: the prison. Inside the prison, captors enact harm through a multitude of mediated forms — architectural, technological, and discursive. In sweatboxing, wooden boxes are used to amplify the sun's rays, intensifying heat in the bodies of people constrained inside. However, as we describe below, the asolar, and the deprivation of sunlight, has been a key tactic of carceral violence. It is impossible, in the prison, to secure even the most basic of "human rights," that is, the capacity to encounter the sun.<sup>4</sup> Describing a critical struggle against the South

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2 Jason De León, *The Land of Open Graves: Living and Dying on the Migrant Trail* (Berkeley: University of California Press, 2015).

3 LaToya Ruby Frazier, *The Notion of Family* (New York: Aperture, 2014).

4 We use the term "human right" with hesitation, heeding the interventions of Sylvia Wynter, Frank B. Wilderson III, and other critics of the category of "human" and its anti-Black, racial-colonial deployment, as well as the well-documented use of "human rights" discourse for justification of imperial aggression. See Dan Kovalik, *No More War: How the West Violates International Law by Using "Humanitarian" Intervention to Advance*

Carolina Department of Corrections, and the broader context of using solar media in solitary confinement, we explore how asolar environments have been weaponized. In turn, we argue that counter-mediations of sunlight made by those held captive articulate a redistribution of sunlight as necessary to freedom.

### “Sunlight Is a Human Right”

In October of 2019, prisoners held by the South Carolina Department of Corrections (SCDC) and their free-world supporters called upon the United Nations (UN) to intervene and see that the state’s prisoners’ demands for basic dignity were met. Organizers and activists used the slogan “Sunlight is a Human Right” to draw attention to the horrific conditions of SCDC’s facilities and the prisoners’ demands in response. Those demands included access to basic educational and recreational programs, and improvement to conditions that included “24 hour solitary confinement without cause, mold, contaminated water, spoiled food, filthy air rushing in all day, no chairs, no tables, no radios, no television, no access to legal work, and no access to showers.”<sup>5</sup> The letter, addressed and delivered to the UN, argues that the conditions produced and maintained by the United States’s carceral apparatus violates international law, and warrants a formal intervention drawing on the tradition of the 1951 petition to the UN, *We Charge Genocide*, signed by W.E.B. Du Bois and Claudia Jones among other Black communists and activists and delivered by Paul Robeson and William Patterson.<sup>6</sup>

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*Economic and Strategic Interests* (New York: Skyhorse Publishing, 2020), and Neda Atanasoski, *Humanitarian Violence: The US Deployment of Diversity* (Minneapolis: University of Minnesota, 2013).

- 5 “Sunlight Is a Human Right — International Humanitarian Intervention Called for By South Carolina Prisoners,” *Incarcerated Workers Organizing Committee*, October 23, 2020, <https://incarceratedworkers.org/news/sunlight-human-right-international-humanitarian-intervention-called-south-carolina-prisoners>.
- 6 William Patterson, *We Charge Genocide: The Crime of Government against the Negro People* (New York: International Publishers, 1970).

In this call for intervention, sunlight was not only an organizing discursive frame, but a vital substance withheld from those inside. By appealing to the UN, situating themselves in the tradition of *We Charge Genocide*, and employing the slogan “Sunlight is a Human Right,” South Carolina prison organizers undermined the white supremacist juridical epistemology of rights and genocide. They wielded what Dylan Rodríguez calls “a de-provincialized genocide concept” that worked to “burst the discursive seams of prevailing languages that avert direct and substantive reference to conditions of normalized, broadly unrecognized forms of systemically induced suffering and degradation.” This was enacted in both discourse and action, enfolding solar access into what Rodríguez calls a “poetics of genocide.”<sup>7</sup>

The prisoners’ third demand reads:

3. We demand the South Carolina Department of Corrections remove all steel coverings off of all windows prohibiting sunlight from entering through the cell windows.<sup>8</sup>

These steel coverings are a form of asolar media, installed to fully block sunlight and air circulation in the 9-by-11-foot of mostly two-person cells where many prisoners were and continue to be held for up to twenty-four hours per day. The incarcerated organizers’ letter pointed out that the purely and cruelly punitive measure depriving prisoners of sunlight is a clear violation of the UN Standard Minimum Rules for the Treatment of Prisoners, known as the Nelson Mandela Rules. Rule 14, section (a) requires that “windows shall be large enough to enable the prisoners to read or work by natural light, and shall be so constructed that they can allow the entrance of fresh air whether or not there is artificial ventilation.”<sup>9</sup> The Mandela Rules, requir-

7 Dylan Rodríguez, *White Reconstruction: Domestic Warfare and the Logics of Genocide* (New York: Fordham University Press, 2020), 147, 153.

8 “Sunlight Is a Human Right.”

9 The United Nations Department of Drugs and Crime, *The United Nations Standard Minimum Rules for Treatment of Prisoners (The Nelson Mandela*



ing *natural* adequate reading and writing light, clearly designate sunlight as a vital substance. The SCDC's light-depriving steel plates go much further than solar restriction. They are a form of violent asolarity, one that leverages people's biological reliance on the sun to re-weaponize the architectural, social, and psychic environment of the prison, inflicting the harm of total darkness. One captive, speaking anonymously with journalist Kelly Hayes, described "a desperate environment, where prisoners brawled in cells without interruption, and where prisoners experiencing mental health crises were 'slicing themselves with razors.'"<sup>10</sup>

In order to understand the violence of the SCDC, it is critical to understand how the prison is an architecture of environmental violence already. Prisons are designed as such efficient chambers of deprivation and withholding that only a single sheet of cheap steel is required to push captives into days-long sunlessness. The steel sheet is not in itself the only technology of asolarity here. It is simply the final one in a long chain of light removing processes and structures: enforced immobility, cinderblock, police, courts, parole officers, anti-Blackness, and the law. All of these carceral technologies contribute to the production of the asolar environment, the deprivation of sunlight, and the threat of darkness.

The effect here of asolar violence is not simply individual harm, a mere separation of prisoner from environment, light, and life. In prisons, human beings are locked together in tiny cages, harassed and assaulted, served inadequate and spoiled food, and deprived of clean water, and all of these techniques are meant to simultaneously enact individualized punishment and at the same time catalyze group punishment. The asolar environment produced so easily by SCDC simply by sliding a

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*Rules*), December 17, 2015, [https://www.unodc.org/documents/justice-and-prison-reform/GA-RESOLUTION/E\\_ebook.pdf](https://www.unodc.org/documents/justice-and-prison-reform/GA-RESOLUTION/E_ebook.pdf).

<sup>10</sup> Kelly Hayes, "South Carolina Prisoners Appeal to the UN for Relief From Torturous Conditions," *TruthOut*, November 1, 2019, <https://truthout.org/articles/south-carolina-prisoners-appeal-to-the-un-for-relief-from-torturous-conditions/>.

steel plate between a prisoner and natural light is used to push even the most resilient prisoners past their limits. This sets off a cascade of effects from the experience of sunlessness, to waves of interpersonal conflict (brawls) and “self” harm (“slicing themselves with razors”); to physical and mental impacts such as Vitamin D deficiency and a destabilized sense of time; and suicide. SCDC’s use of sunlight deprivation fits into a larger strategy of violence, which has included planned, premeditated deployment of gas and chemical weapons<sup>11</sup> and the deadly engineering of riots.<sup>12</sup> In a perverse carceral allegory for the cycle of Earthly life, the sun’s administratively and technologically produced absence works on the entirety of the prison through the skin and bodies of imprisoned people.

### Solar Isolation

SCDC is not alone in getting between the sun and those held captive in prisons. Sunlight deprivation and the construction of asolar environments is a mainstay of carceral isolation, imposing a range of tortuous medical effects. A prisoner at California Department of Corrections and Rehabilitation’s (CDCR) San Quentin State Prison describes two methods of weaponizing sunlight against captives: overexposure and total deprivation. They write:

Unlike the torture cages in the SHU III D.R. (The Adjustment Center) which are completely exposed to the elements with no protection whatsoever, the SHU II D.R. torture cages have

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- 11 Over a six-month period, SCDC deployed gas 457 times, 69 of which were planned. See Jared Ware, “South Carolina Prisoners Call for UN Intervention as Abusive Conditions Worsen,” *Shadowproof*, December 17, 2019, <https://shadowproof.com/2019/12/17/south-carolina-prisoners-call-for-un-intervention-as-abusive-conditions-worsen/>.
  - 12 Jared Ware, “Interview: South Carolina Prisoners Challenge Narrative Around Violence at Lee Correctional Institution,” *Shadowproof*, May 3, 2018, <https://shadowproof.com/2018/05/03/interview-south-carolina-prisoners-challenge-narrative-around-violence-lee-correctional-institution/>.

a corrugated steel cover over 1/4 of its top and every one of these 40 or so cages are under a gigantic modified metal pavilion which could be comparable to a rusted metal circus tent. The only direct sunlight penetrating this bizarre big top of the CDCR circus pierces through rust holes in the massive metal canopy.<sup>13</sup>

Just as SCDC mobilizes a single steel plate as a solar technology in order to intensify the asolar effects of existing carceral architectures, here the CDCR's torture cages are likewise constructed specifically with solar orientations in mind. They force people either endure the sun directly with no protection, or subject them to an asolar environment.

These conditions, architectures, and practices are commonplace. It is difficult to estimate the number of people held in solitary in the US, due to the prison system's decentralized, almost feudal organization and the constant innovation of new forms of isolation that are not officially recognized as such, and are designed and named precisely against that recognition. But solitary confinement remains a widespread practice in United States prisons and jails, despite being re-christened into a litany of abbreviations like SHU, RHU, SMU, POC, and AdSeg. According to Solitary Watch, the minimum number of people held in solitary on a given day is above 60,000 and could be as high as 100,000.<sup>14</sup> It has been estimated that in the years 2011–12 about 400,000 spent some length of time in solitary.<sup>15</sup> And many of

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13 "Bringing the Truth to Light: The Result of Sunlight Deprivation at San Quentin," *prisoncensorship.info*, August 2014, <https://www.prisoncensorship.info/article/bringing-the-truth-to-light-the-result-of-sunlight-deprivation-at-san-quentin/>.

14 Joshua Manson and Jean Casella, "Solitary Confinement Gets Another Sharp Rebuke from a Supreme Court Justice," *Solitary Watch*, March 20, 2017, <https://solitarywatch.org/2017/03/20/solitary-confinement-gets-another-sharp-rebuke-from-a-supreme-court-justice/>.

15 Brie A. Williams, "Older Prisoners and the Physical Health Effects of Solitary Confinement," *American Journal of Public Health* 106, no. 2 (2016): 2126–27.

these solitary environments, as the CDCR's torture cages exemplify, are constructed as a mode of mediating sunlight.

The architectures and practices of solitary confinement have an enormous psychological toll, including "hallucinations, anxiety, withdrawal, aggression, paranoia, depression, and even suicide."<sup>16</sup> These effects are felt even more acutely by prisoners with various health conditions, and by the estimated 44,000 people over the age of 45 who are held in carceral solitude.<sup>17</sup> Sunlight is used, not only in South Carolina, but across the United States as a means of intensifying these psychological effects. Whether subjecting prisoners to thermal radiation or placing them in the complete darkness, the use of solar and asolar media in solitary confinement enfolds sunlight into the modes of isolation and deprivation that make up the soul of penal practice, and their violent permutations form mutually compounding chains of harm. Distance from family combines with lack of social contact, malnutrition interacts with lack of bodily mobility, hyper-surveillance complements sensory deprivation. Here, solarity is not simply used as a means of disaggregating prisoners, but as a means of amplifying and intensifying existing forms of bodily manipulation.

One of the many ways this carceral asolarity works on the bodies of prisoners is by inhibiting the production of Vitamin D. Medical Doctor Brie A. Williams, evaluating the health impacts of solitary confinement on older prisoners, argues that "a prolonged lack of sunlight can cause Vitamin D deficiency, putting older adults at risk for fractures and falls, a leading cause of hospitalization and death."<sup>18</sup> The asolar environment of prison, finding its most extreme expression in solitary confinement, results in widespread Vitamin D deficiency that can literally break bones and, in the case of aging prisoners, lead to

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16 Lucius Couloute, "Aging Alone: Uncovering the Risk of Solitary Confinement for People over 45," *Prison Policy Initiative*, May 2, 2017, [https://www.prisonpolicy.org/blog/2017/05/02/aging\\_alone/](https://www.prisonpolicy.org/blog/2017/05/02/aging_alone/).

17 Ibid.

18 Williams, "Older Prisoners and the Physical Health Effects of Solitary Confinement."

death. Given the prison's tendency to accelerate biological aging of its long-term captives, asolarity's intensification of bodily vulnerability is a deadly threat to incarcerated people.

Another danger of asolar isolation has been augmented by the SARS-CoV-2 pandemic, which has decimated prisons from the beginning of the outbreak. According to a May 7, 2020 study, there appears to be a correlation between Vitamin D deficiency and COVID-19 mortality. Though the data is not conclusive, it suggests that "patients with severe deficiency are twice as likely to experience major complications" with COVID-19.<sup>19</sup> Vitamin D deficiency is also linked to melanation, and "dark-skinned individuals with higher melanin content will experience slower vitamin D synthesis in comparison with light-skinned individuals."<sup>20</sup> When Black people are six times more likely to be locked up than their white counterparts, and imprisoned Black people are more likely to end up in solitary confinement, and because dark-skinned Black people are more likely to suffer from Vitamin D deficiency, asolarity scaffolds the prison's architecture of anti-Blackness.<sup>21</sup> During a pandemic that has torn through crowded prisons full of malnourished, aging, immobilized human beings, over 130,000 of whom have suffered from COVID-19, asolarity has become an even sharper instrument of genocide.

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19 Amanda Morris, "Vitamin D Levels Appear to Play Role in COVID-19 Mortality Rates," *Science Daily*, May 7, 2020, <https://www.sciencedaily.com/releases/2020/05/200507121353.htm>.

20 Naveen R Parva et al., "Prevalence of Vitamin D Deficiency and Associated Risk Factors in the US Population," *Cureus* 10, no. 6 (June 2018): e2741.

21 Wendy Sawyer and Peter Wagner, "Mass Incarceration: The Whole Pie 2020," *Prison Policy Initiative*, March 24, 2020, <https://www.prisonpolicy.org/reports/pie2020.html>, and "Report of the Sentencing Project to the United Nations Special Rapporteur on Contemporary Forms of Racism, Racial Discrimination, Xenophobia, and Related Intolerance," *The Sentencing Project*, March 2018, <https://www.sentencingproject.org/publications/un-report-on-racial-disparities/>.

## Shining a Light on Prisons

The revelation of carceral violence is often framed as “shining a light” on prisons and prisoners. *The New York Times*, in an article entitled “Inmates’ Videos Shine a Light on Life in Prison” reports on *Hidden Lives Illuminated*, a media project that worked with people inside to develop short, animated films.<sup>22</sup> Broadcast on the walls of Eastern State Penitentiary, these images, project organizers hoped, would catalyze awareness and possible reform. In a letter to the editor of the *New York Times* also titled “Shine a Light on Prisons,” Jennifer Scaife, executive director of the Correctional Association of New York, echoes the fundamental assumption of such projects: “Prisons are violent places because they are cut off from public view.”<sup>23</sup> And prison chaplain Dwight Burch expresses the same sentiment, but with a faith-based mission, where it “feels like I am holding a flashlight directly on someone that has been stuck in the dark for the better part of their life.”<sup>24</sup> Whether an animated film, a newspaper, a flashlight or a chaplain, mediating the violence, deprivation, anguish, and torturous conditions of the prison is often naturalized as a form of illumination, one that will simply lead to reform or improved conditions for people inside.

While the “shine a light” metaphor is deeply connected to western enlightenment thought, it is also naturalized by many popular assumptions about the sun: the sun is naturally giving, it fosters growth, and it is equally accessible by all. Our attention here to asolarity in the prison, however, reveals how sunlight is highly managed. Solar and asolar media, whether steel pan-

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22 Jon Hurdle, “Inmates’ Videos Shine a Light on Life in Prison,” *The New York Times*, August 18, 2019, <https://www.nytimes.com/2019/08/08/arts/design/hidden-lives-illuminated-prison-videos.html>.

23 Jennifer Scaife, “Shine a Light on Prisons,” *The New York Times*, April 3, 2019, <https://www.nytimes.com/2019/04/03/opinion/letters/prisons-inmate-deaths.html>.

24 Dwight Burch, “Shining a Light in the Darkness of Prison to Bring Hope and Change Lives,” *Global Leadership Network*, March 16, 2020, <https://globalleadership.org/stories/shining-a-light-in-the-darkness-of-prison-to-bring-hope-change-lives/>.



*Fig. 1.* This image from the Hidden Lives Illuminated project casts a light illuminating a zoetrope as a kind of sun, lighting up not only a nineteenth century animation technology, but the faces of those incarcerated at Eastern State Penitentiary. Source: <https://www.easternstate.org/hiddenlives/about-the-project/>.

els, torture cages, or the prison architecture itself, fundamentally alter the direction, accumulation, and form of radiation, in ways that are intended to produce social effects. These include the sense of intense isolation; vulnerability to illness and violence; the engineered provocation of inter-group conflicts; and the intensification and infliction of countless other harms. Harnessed as part of the prison's operation, sunlight proves to be an essential substance in a "durable material structure of normalized social liquidation."<sup>25</sup>

In this context, the struggle over "Sunlight is a Human Right," in resistance to the violent tactics of the SCDC, offers a critical insight to our conceptualization of solarity and the sun. The framing and the invocation of the Mandela Rules not

<sup>25</sup> Dylan Rodríguez, *Forced Passages: Imprisoned Radical Intellectuals and the U.S. Prison Regime* (Minneapolis: University of Minnesota Press, 2005), 223.

only reveals how impossible it is to secure even the most basic “human rights” in the fundamentally de-humanizing, rights-depriving institution of the prison, but reveals that the capacity to mediate sunlight—to control one’s access to it—is fundamental to freedom.



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## Colonial Exposure

*Aylin Kuryel*

The sun was shining on the sea,  
 Shining with all his might:  
 He did his very best to make  
 The billows smooth and bright  
 — And this was odd, because it was  
 The middle of the night.

— Lewis Carroll, “The Walrus and the Carpenter”

We hear a cassette being put in a tape recorder, and it starts recording. On a black screen, the deep voiceover speaks: “Nature sends us signals of danger or violent encounters.” A barren field, a curtain of sand in the air. “White missionaries took us out of our paradise.” Two dead horses lying on the land, a car passes by. “And I wonder, what was our sin?” This is Mateo speaking, as he explains his original name was Sobode Chiqueno, before he was forced to quit the forest and convert to Christianity, as most of the Indigenous Ayoreo people in Paraguay have been since the 1950s. Although some still live in isolation in the forests, most now live in the barren and hot Chaco region with their land stolen, divided, and sold. The tape recorder stops, and the name



Fig. 1. Still image from *Apenas el Sol (Nothing But the Sun)* (2020, dir. Arami Ullón). Courtesy of the director.

of the film appears on the screen, *Apenas el Sol (Nothing But the Sun)* (2020, directed by Arami Ullón).<sup>1</sup>

The film follows Mateo's journey while he records his own reflections and conversations with others since the 1970s, with an old tape recorder, a medium that is in fact brought by the missionaries to distribute audio recordings of the Bible to the displaced Ayoreo community. Mateo subverts and repurposes the medium itself, while trying to accumulate stories of a community with a fading sense of belonging. *Nothing But the Sun*, made possible by a rare form of collaboration between Mateo Sobode Chiqueno and the director Arami Ullón,<sup>2</sup> generously lays out the material consequences of colonialism and capitalism in the region, and offers fragments of a collective contemplation on being uprooted. To be uprooted in this context generates an unsettling relation to the solar through being exposed to it, and being exposed to it differently, after having to leave the

1 Arami Ullón, dir., *Apenas el Sol (Nothing But the Sun)*, 75' (2020) was the opening film of the International Documentary Film Festival Amsterdam (IDFA) in the Netherlands, between November 18 to December 6, 2020.

2 In our interview, Arami Ullón shared that she would sit with Mateo every day during the shoot to decide how to shape the rest of the shoots. The small film crew went there for three years without cameras and had forty hours of footage after twelve weeks of shooting. The interview was made on December 12, 2020 with Fırat Yücel, for *Altyazı Cinema Magazine's* supplement *Altyazı Fasikul: Free Cinema*.

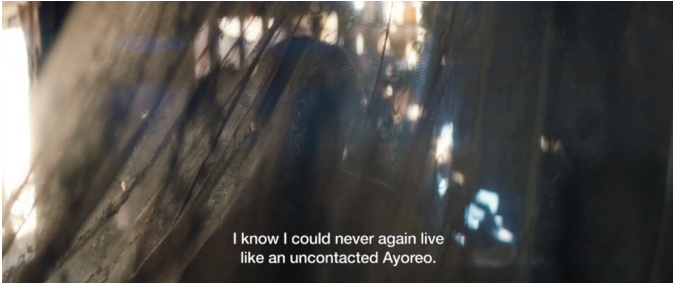


Fig. 2. Still image from *Apenas el Sol* (*Nothing But the Sun*) (2020, dir. Arami Ullón). Courtesy of the director.

forest with the arrival of the missionaries in the late 1950s and the early '60s. What seems to be the driving force of Mateo's search is not the hope of reconstructing a lost culture and identity through collecting its fragments, but rather the urge to meditate on its impossibility. One of the most crystallized manifestations of this impossibility is the drastically altered relation to the solar, upon which both Mateo in his recordings and the film itself reflects, turning the encounter between the people and the sun into a violent one as one of the material consequences of being displaced.

José Iquebi, who was captured and forced to help white people find other Ayoreo in the forest in the late fifties, tells Mateo that he was deadly scared when he first saw the flashes of the photo cameras since his grandfather told him, "it's the guns that have flashes." José's uncanny analogy between photo cameras and guns — long before drones were used as weapons — sharply alludes to the destructive capacity of image-making. Exposure emerges as a caustic condition on multiple levels, where the exposure of the film to the light produces the image, which then exposes people to the colonizers by turning them into objects of knowledge, enabling locating and targeting. Consequently, people are removed from their land, which radically transforms the way they are exposed to the sun. The film unpacks the changing dynamics of their relationship to the solar, with solid yet gentle

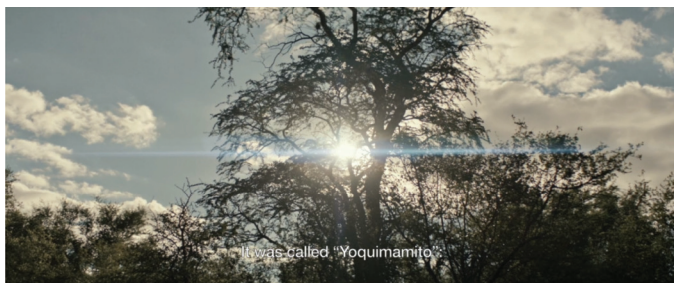


Fig. 3. Still image from *Apenas el Sol (Nothing But the Sun)* (2020, dir. Arami Ullón). Courtesy of the director.

steps, aware of “the depth of responsibility that comes when we tarry with the infinite.”<sup>3</sup>

The sun appears throughout the film not as an infinity without context, nor as a metaphor, but as a material entity within which meaning and function change drastically throughout colonial history. Mateo tells us that his ancestors worshipped the sun, which they called Yoquimamito, “a superior and generous being protecting us from above.” While detailing a technique in which his tribe would climb up the tress for the sun to hear them better, we see the sun shining through the trees. The scene cuts to a loudspeaker placed very high, and we hear a priest preaching at dusk, and the sun seems to be replaced by the words of the god brought by the whites. This is not the only alteration the sun goes through for the Ayoreo who live in the remote, deforested region, where the land and the wild animals belong to the white people and the Chicoi root of water once running under their feet can now only be found on private property.

3 Imre Szeman, “On Solarity: Six Principles for Energy and Society After Oil,” *Stasis* 9, no. 1 (2020): 136.





Fig. 4. Still image from *Apenas el Sol* (*Nothing But the Sun*) (2020, dir. Arami Ullón). Courtesy of the director.

### Redistributing Shame

Before unpacking the formal and conceptual figure of the sun in the film, let's rewind for a moment, together with Mateo, and press play. We are listening to the various testimonies that Mateo records throughout the film, and those testimonies shed light on the ways in which the encounter between white people and Indigenous people has been deadly on various levels since the beginning of missionary practice. Ayoreo people were poisoned by the food brought by the settlers. They got sick from the viruses the colonizers carried with them. Cattle ranchers shot people who refused to leave the forest. As the conversations multiply, affects pile up: shame, hope, grief, and nostalgia. Shame is sown in the community to "weaken them by being ashamed of their culture," in Mateo's words. It comes with learning to measure community values through colonizers' standards. Hope lingers in dreams of having a better life among white people, a dream that some community members still hold on to and uneasily reflect upon. Grief taints these words, alluding to the unrealized hopes, stolen lands and animals. It runs like a multiple fissure through conversations. Nostalgia, according to Pebidate to whom Mateo asks to do a blessing ritual, "leaves one sleepless at nights if allowed into the soul." Pebidate is the only person who still practices shamanic healings, and she says she

can still do it because she has no more reason to be ashamed. She has no more fear of being exposed. The film's narrative starts with shame and ends with its absence. At the heart of this interplay between the presence and absence of shame, other questions lurk. Is recording and archiving whatever is left of the past, as Mateo does, a way of getting rid of shame? Is it a way of owning the image and sound by becoming the agents of exposing history? Is filming Mateo's journey a way of transferring part of this shame to the viewer to open up space to discuss complicity, continuity, and proximity?

In one of the last scenes, we see the government agents coming to the area to distribute government handouts of 65 USD per family, which is given every two months, while Paraguay's minimum wage is 300 USD per month. People need to show their Paraguayan identity card, which doesn't specify that they are Ayoreo, and give their fingerprints to collect the money, while there is armed security around. In this twilight zone of surveillance capitalism operating on the colonized land, Mateo says, "thankfully, so far no one has claimed the sun as their own. Maybe the sun is the only thing white people don't consider their property yet." The forest used to be their protection, like a "soft blanket," yet now they are stuck in this desolate place without any vegetation. For decades, trees are cut down to make more space for animal stock and beef farming. The same sun, with which they once communed from the trees, now acts as an agent of aridity and transformed from a companion into a threat. The sun that used to be benevolent when they were still living in the forest under the protection of the trees, which allowed fruit to grow and animals to live, is now a brutal energy, not the source of vitality but a deadly entity. When there is no more a mediating milieu between the sun and the people, the encounter turns violent, exposure to the solar rays become destructive.<sup>4</sup>

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4 Arami Ullón, in our interview, reminded that currently in Paraguay, one is allowed to fully deforest the land they own, which is a law implemented by the current government led by the president Mario Abdo Benítez, who used to be the right hand of the dictator Alfredo Stroessner, who ruled Paraguay between 1954 and 1989.



Fig. 5. Still image from *Apenas el Sol* (*Nothing But the Sun*) (2020, dir. Arami Ullón). Courtesy of the director.

### But the Sun

At the end of the film, Mateo likens Ayoreo people to a cut tree, one that dries and dies as we see red smoke fills up the sky. The forest is burning, and the sun appears behind the smoke. Its warmth is certainly not felt under a soft blanket anymore. While watching the sun, the viewer feels suffocated too. Things that are on the verge of extinction pile up in a sweltering way: the forest, Ayoreo memories and language, and eventually humankind, unless the regimes of property are altered. “There” becomes “here,” “then” becomes “now,” as around the globe, it is nothing but the same sun that we all see in the sky. It is not a source of infinite energy nor a source of vitality without transforming our relationship to property.

Yet, there is a last twist to what the image of the sun behind the smoke might tell us. It looks like it is shining in the middle of the night, This is a world where there is *nothing* that is not turned into private property *but the sun*. As Szeman asks, “how can one own what is infinite?”<sup>5</sup> Mateo presents it as the only natural source that is not commodified yet and the film uses this insight as a framework, visible in its title, portraying the sun as resisting to be owned, reminding the possibility of another world, not one that will be restored but one yet to be imagined.

5 Szeman, “On Solarity,” 131.

This framing alludes to the vitality of the sun for memory retention. Refracting into the dark rooms of memory and history, it shines as an archive that reminds the cultural and ecological destruction of beings and relations brought by colonialism and capitalism and the urgency to reshuffle our existing coordinates.

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## Solar as Narrative Element: The Interrupting Surface

*Rhys Williams*

The episode begins with a drone shot across the steel and glass spires of London's skyscrapers, cutting inside to a young businessman striding through corridors high above the city, a dramatic parody of *The Apprentice* UK theme tune, "Dance of the Knights" by Sergei Prokofiev, playing in the background. He arrives at a boardroom in time to hear the end of a business pitch:

For centuries man has looked for the Earth's bounty below the ground, but now we are on the brink of a new age of clean, carbon-neutral energy production from the Sun, and the treasure, ladies and gentlemen, is very much above our heads.

The speaker stands in front of pop-up banners carrying the venture's name, "Photon Harvest," and the tagline "an unlimited resource all above our heads." He steps to the central table and unrolls a large satellite image of green fields. The camera swoops up over the table and descends, entering into the image, leaving

the boardroom behind and panning slowly down to two figures striding across the field in glorious sunshine, carrying metal detectors. “Look at that,” one says to the other with innocent satisfaction, “not a cloud in the sky.”

This is the opening scene of season three of the much-loved homely British comedy, *Detectorists*.<sup>1</sup> Across the previous two seasons we have followed the minor trials and victories of our two protagonists, Lance and Andy, as they navigate their everyday lives and regularly escape to pursue their passion for metal detecting on the fields of Church Farm. They live in the invented town of Danebury in Essex, an area of England recognized for its archaeological riches. They’ve had some significant historical finds — season two ends with Lance unearthing a late-Saxon gold *æstel* — but these are exceptional climactic breaks from the typical coins and ring-pulls that make up the routine hauls of their hobby. The prospect of the solar site establishes the narrative drive of this final season. Six episodes later the show ends forever with the solar fields in place, with our heroes no longer granted the farmer’s permission to pursue metal detecting on Church Farm.

A poetics of weightlessness and light, of being sheer surface without depth or footprint, has come to dominate popular, corporate, and activist representations of solar technologies.<sup>2</sup> This widespread uptake is due to solar’s narrative and aesthetic affordance as an *interrupting surface*, acting to break the purchase of history upon the present, and excusing imaginaries of the future from the need to engage with the past. The poetics of solar perform an ontological and political assertion in an aesthetic register. This claim will be explored through three examples in the final season of *Detectorists*: firstly, solar as facilitating the reorientation and continuation of capital beyond the fossil-

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1 Mackenzie Crook, dir., *Detectorists*, season 3, episode 1, BBC 4, November 8, 2017.

2 Rhys Williams, “‘This Shining Confluence of Magic and Technology’: Solarpunk, Energy Imaginaries, and the Infrastructures of Solarity,” *Open Library of Humanities* 5, no. 1 (September 2019): 60.



fuel age; secondly, solar as interrupting a particular relationship to history and land and establishing a new arrangement, where our attention is instead drawn to the future, and upwards, to the sun, which is read through solar's impact upon the show's generic language; and thirdly, solar deployed to end the conditions of possibility for a narrative, which is a rare complement to its typical narrative affordance as a vehicle for allowing narratives to continue, cleansed of historical baggage or as a platform for generating new ones.

### Capital's Gaze: From Depth to Surface

The adoption of coal as primary fuel source in the nineteenth century inaugurated an era of deep extraction as the master-signifier of resource production. Prior to this, biomass in the form of trees and animals harvested from the surface of the earth, coal grazed from just under it, or the flow of water or wind to power turbines provided for the needs of humanity. With deep-mined coal, and then fossil fuels more generally, the gaze of capital turned conclusively to the depths. In doing so it turned to exploit the riches of the past more fully, the eons of captured sunlight, growth, death, and downwards pressure that formed the buried carbon-rich sources of modernity's power. This reorientation of its energetic input was driven, it has been argued, by its facility to allow capital greater control over the tempo and geographical arrangement of its productive powers, doing away with the limiting frustrations occasioned by previous reliance on seasonal flows and quirks of landscape.<sup>3</sup>

In all-too-slow response to the climate crisis, capital is gradually reorienting itself away from these underground sources and turning its gaze upwards to preserve itself. Here we shift from a metaphor of extraction to one of gathering or harvesting, from a system parasitic upon the past to one grasping at the future as it falls in steady streams from the sun. These two polar systems

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3 Andreas Malm, *Fossil Capital: The Rise of Steam-Power and the Roots of Global Warming* (London: Verso Books, 2015).

are united in this case by their facility to produce energy and profit, and the surface of solar spread over the earth interrupts the previous bowels-focused gaze by providing the means to spin light into gold and acts as a fulcrum around which capital can relocate the source of its treasure from beneath the ground to the sky above. In coating the ground, the surface of solar negates both our capacity and our need to look below.

Photovoltaic solar (PV), from ubiquitous panels to experimental paint, is the apotheosis of solar as *surface*. Fully distributable and extendable, it carries the promise of coating every facet of our energy-dependent technological society, sealing buildings and infrastructure off from the troubled networks of fossil fuel extraction, distribution, and consumption, and interrupting the present's dependence upon them. Whatever it touches it appears to liberate from the problems inherent in a relationship to depth and history and the difficulties of the metabolic rift of fossil-fuel consumption driving up the inexorable carbon counter of parts per million. In doing so it facilitates a narrative in which the present can continue without radical change, without addressing the inequities of our history, requiring merely a lick of PV paint to transform it into the figure of a shiny clean future.

Solar's surface of interruption here provides the technological means to facilitate a more profound continuation, from fossil capital to solar capital. If "Wall Street is a way of organizing Nature," then the camera's movement in the opening scenes—from the City of London to a boardroom to an abstract cartography of fields to the fields themselves and the people whose lives are entangled with them—enacts these relations, moving along conduits of capital flow as they effect material change far from the financial center.<sup>4</sup> The narrative sense, and the agency that drives the narrative, is here captured as the invisible linkages connecting boardroom to newly minted solar site. The logic of the camera's narrative flow here traces the logic

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4 Tom Keefer, "Wall Street Is a Way of Organizing Nature: Interview with Jason Moore," *Upping the Anti*, August 16, 2017, <https://uppingtheanti.org/journal/article/12-wall-street-is-a-way-of-organizing-nature>.

of capital's flow. And what flows is business as usual. As technological solution for the status quo, solar carries the drab utopian promise of a future much like the present: in 2030,

Solar PV isn't just powering glamorous urban buildings or massive industrial plants; PV materials are now light enough to be supported by flimsy shanty roofs in the slum outskirts of megacities in the developing world.<sup>5</sup>

Under this shiny new assemblage, nothing has fundamentally changed, and both rich and poor alike are still forbidden from sleeping under solar-paneled bridges, and wealth continues to flow to the financial hubs from peripheries of extraction.

### Generic Shifts: The Weight of Light

In reality, of course, solar is not free from depth or darkness. Its weightless poetics of light and surface belie both upstream extraction and production and downstream waste and disposal.<sup>6</sup> It belies the extension of colonial history, enacted through landgrabs and externalized costs, reframing deserts as peripheral goldmines of sunlight to be extracted and channeled to the core, decisions taken and money moved in distant boardrooms bent over abstract maps. It also belies the reality that solar is not only distributed PV panels but concentrated solar power plants (CSP) too. These vast steam engines squat heavily on the landscape, yet even here the public relations machine bends them to weightlessness as best it can. God's-eye images flatten them and the complexities of the desert ecologies in which they sit, striving to naturalize these titans within an apparently bare landscape of mountains and plateaus.<sup>7</sup> *Detectorists* features far less

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5 Varun Sivaram, *Taming the Sun: Innovations to Harness Solar Energy and Power the Planet* (Cambridge: MIT Press, 2018), 8.

6 Dustin Mulvaney, *Solar Power: Innovation, Sustainability, and Environmental Justice* (Berkeley: University of California Press, 2019).

7 Jamey Stillings and Bruce Barcott, *The Evolution of Ivanpah Solar* (Göttingen: Steidl, 2015).

intrusive fields of pv. A CSP plant on the outskirts of Danebury, on the other hand, could hardly not loom dystopian. It would be an interruption for sure but one that would break the bounds of the narrative's realism, bursting the *Detectorists's* frame of the homely comedy genre, and by extension the sensibilities of Middle England, transporting us suddenly to an unexpected future. Dennis Villeneuve's choice to open his 2017's *Blade Runner 2049* with endless fields of CSP straining in the gloom is the aesthetically correct one with regards to the poetics of solar infrastructure. They are the obviously retro, industrial, colonial, capital-intensive, centralized choice, freighted with history like a nightmare weighing upon the living.<sup>8</sup>

In *Detectorists*, solar interrupts the flow of narrative that carries historical meaning through the present and into the future. It does so by taking away and coating over the place that hosted the narrative, and the specific depth-oriented relationship to history that was played out there. In characters Lance and Andy's world, detecting is a source of potential magic, meaning, and value. It is also, importantly, a source of interruption. Their hobby provides them with a sense of purpose and beauty that rises above their mundane lives equaled only, in the end, by love, when the final season provides emotional and formal closure by replacing the lost hobby with a making-good of their love lives. The objects unearthed punctuate the present with glimpses of lost ages, mysteries unsolved, ways of life long-lost, and, of course, the monetary value that accompanies the value placed upon history-as-heritage. *Detectorists*, a resolutely realist comedy, dramatizes this affect of history by punctuating the realism with moments of mild eeriness. Ghostly scenes pervaded by haunting folk-singing show the objects being lost or buried long ago, and Lance is alerted to the presence of a rare æstel by an otherworldly echo of thundering hooves. The overall effect is that of an eerie "failure of presence," where the objects conjure the cultures and symbolic structures which made sense of the objects and which have now long since disappeared, leav-

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8 Denis Villeneuve, dir., *Blade Runner 2049* (Sony, 2017).

ing us confronting “the unintelligibility and the inscrutability of the Real itself.”<sup>9</sup> The political resonance of the eerie is thus as a kind of *memento mori*. On the one hand it draws attention to the invisible structures that make our present make sense by contrast with the conjured absent paradigm of the past. On the other hand, it says that “this too shall pass.” Yet in the final season, with the solar panels installed and the fields out of bounds to our detectorists, the solar surface interrupts the narrative’s access to the depths of historical meaning communicated through and mobilized by the eerie, negating it as a mode of estrangement and so negating its potential political charge.

### Solar Narratives: An End as well as a Beginning

In *Detectorists*, solar is deployed to interrupt the conditions of narrative possibility. Lance and Andy can no longer pore carefully over the ground, lovingly brushing dirt from the historical objects, mundane and spectacular, that they unearth.<sup>10</sup> As narrative element, solar always carries the present into the future by interrupting its relationship with the past, either by proposing to make business-as-usual livable in a narrowly environmental sense or, much the same in terms of narrative affordance but rooted in a more radical political desire, providing a platform for revolutionary new livable narratives to begin, free of the petrocultural era’s poisons and path dependencies. In imaginaries ranging from Ian McEwan’s realist novel *Solar*,<sup>11</sup> through neoliberal futures,<sup>12</sup> to the radical speculative solarpunk canon,<sup>13</sup> solar takes the form of sheer interrupting surface, with the narrative affordance of negating history and offering a fresh start, of

9 Mark Fisher, *The Weird and the Eerie* (London: Repeater, 2016), 63.

10 As one reader of this chapter pointed out, this is already a taming of the radical potential of history to a hobbyist’s enthusiasms. As I hope is clear, *Detectorists* is not a particularly radical show, and therein lies its interest here.

11 Ian McEwan, *Solar* (London: Vintage, 2011).

12 E.g., Sivaram, *Taming the Sun*.

13 E.g., Williams, “Shining Confluence.”

redemption from the past, no matter how undeserved. In *Detectorists*, however, we see solar as future-bearing only in so much as it brings a particular narrative present, a particular mundane, realist scenario, to an end. This makes it a rare entry into the solar mega-text that manifests its power to register “processes of decay.”<sup>14</sup> Genuinely radical innovations do not only present new opportunities, but “render previously important forms of competence redundant; and [...] reconfigure interpretations of value and significance.”<sup>15</sup> If this is the case, then narratives driven by future-bearing innovations should register both opportunity and decay, both the birth and death of practices. It is a mark of how much inflated hope is invested in solar that, once installed, it is depicted as interrupting the flow of history to the extent that history is simply no longer relevant.<sup>16</sup>

The present of *Detectorists* is a petrocultural one, not unique to the United Kingdom but certainly representative of it. The fallow field that facilitates detecting; the decades of mechanized tilling that pulls the objects close to the surface; the arrangement of urban and rural; even, banally, the cars and roads that provide access, are all fossil-fueled. The history that speaks to our detectorists through their finds is one that skips over the fossil-fueled present, over the long era of capital, one that harks back to romantic notions of earlier Britons, earlier ways of life and modes of production, unrationalized, mysterious, and

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14 Elizabeth Shove, “Beyond the ABC: Climate Change Policy and Theories of Social Change,” *Environment and Planning A: Economy and Space* 42, no. 6 (June 2010): 1278.

15 Ibid.

16 A rare exception to this rule is the collection Joey Eschrich and Clark A. Miller, eds., *The Weight of Light: A Collection of Solar Futures* (Tempe: University of Arizona Press, 2018), featuring four short stories, three of which dramatize the way a solar future leaves something behind: a town previously dependent upon coal for its living; an old woman whose house doesn’t meet new sustainable regulations; a poor part of town experiencing power loss as the energy generated by the city grid is sold elsewhere for profit. This collection is, however, the product of collaboration between authors and academics, and it suffers from its own issues, principally the repeated use of the hybrid individual protagonist with one foot in both worlds to neatly resolve the social and infrastructural contradictions.

thereby capable of wonder. Spreading itself over the field, solar is then an interruption of a source of interruption, a negation of the capacity of place to contain traces of radical historical difference. A negation, in generic terms, of a capacity for the eerie, rendering mute the haunting failure of presence that is a mark of history. Henceforth, the field will be a mark of the future-as-eternal-present, an eternal present distinguished by looking always forwards, always up, concealing beneath its glossy surface the possibility of unearthing difference.<sup>17</sup> The product of a cultural imaginary that lacks a strong sense of a living alternative to the petrocultural present, *Detectorists* reveals the narrative impasse produced by thinking with solar under such circumstances: it can act as the vehicle for imagining a renewed future, but it covers over the past and polishes the present free of any historical blemishes that might otherwise require discomfort and acknowledgement.

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17 Contrast this to the ongoing Indigenous solar projects in Canada, where the hope is for solar to interrupt the transmission of colonial energy extraction relations from the present into the future, winning energy independence from the state that historically exploits their land for fuel. Here solar can be understood as negating an unwanted and (relatively) recent history, providing a platform for the resurgence of Indigenous culture.

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## Living Too Close to the Sun

*Daniel A. Barber*

In Greek mythology, the flight of Icarus is a tale of both material and psycho-social overreach. Icarus's wax and feather wings are delicate and fragile, clearly under-engineered for the flight he and Daedalus attempt. And yet, Icarus's hubris famously pushes him to surpass his wings' reasonable limits, feathers falling from the sun-melted wax. His ill-fated flight builds out of Daedalus's excavation of the Minotaur's labyrinth. It is posed as a reaching toward the sun that stands in contrast to, and as a consequence of, terrestrial extraction.

Current Icarian hubris retains a connection to terrestrial excavation. This connection is represented in the overreaching cycles of extraction, processing, and emission, through which carbon energy is materialized in the built environment, and which in turn creates the degenerating feedback loops of climate instability and economic inequity that contemporary skyscrapers and other monuments to excess continue to exacerbate. Like the mythical Icarus, we cannot overcome these material limitations, though recent so-called supertall residential towers aim to do so. They aim, that is, to ignore, if not exactly overcome, the resource dependencies they embody. While these kinds of ventures may not as yet be generally felt and experienced, they

nonetheless frame a structure of excess and of reaching for the sun that has broad material and cultural consequences.

Since about 2010, a half-dozen or so so-called supertall residential towers have risen in Manhattan, puncturing the skyline. Sometimes referred to as pencil towers for their tall, skinny profile, these buildings have come to represent the pinnacle of a contemporary form of architectural excess. They are both an engineering and design feat to an extent and also a virtuosic expression of the financial machinations of the super-rich: the vast majority of these multi-million-dollar apartments are purchased as assets rather than homes. In short, they are evidence of a now-emerged structural aspect of the global economy put in place by the seemingly endless real estate “boom” that continues to shape many so-called global cities, perpetuated by a cycle of valuation, purchasing, and repurchasing, as well as shell companies and real estate investment trusts that have spun out as part of the familiar accelerations of capitalism.

Further, the pencil towers also reveal the ambitions of developers and architects to market a different kind of natural environment, a sun-soaked perch high above the chaos below. To facilitate the extreme height this environment requires, building codes must be manipulated, which is no easy feat in New York City where interpreting and maneuvering strict codes is an industry in and of itself. In the case of supertall towers, the experts rely on two related tricks, both of which take advantage of a bureaucratic loophole: when a building’s height is assessed relative to the specific limitations of its precise location, floors that do not contain habitable space are not taken into consideration. Thus, in the administrative building approval process, it is not the actual built height that is at stake, but the manipulated height as calculated in the permit application, a hubristic reach closer to the sun.

To take advantage of the bureaucratic invisibility of uninhabited floors, the first trick developers use is to create entire floors dedicated to mechanical systems. Take for example 432 Park Avenue, one of the better known of these pencil tow-

ers. Designed by Raphael Viñoly Associates and completed in 2015, the building has a number of double- and triple-height floors containing only mechanical systems. These mechanical systems, and the height they add to the building, represent a felicitous feedback loop in which extreme height significantly increases the demands on and scale of mechanical systems. For instance, windows cannot be opened on high floors given the wind speeds and temperature at that atmospheric level, so the building is fully sealed, and conditioned by a robust air-conditioning and heating system. Because such HVAC (heating, ventilation, and air conditioning) systems are powered by fossil fuels, this building trend, then, exhibits no interest in the sorts of innovations or derivations relevant to sustainable architecture as the excess height is facilitated by an excess of energy use.<sup>1</sup> Similarly, some of the tall, mechanical floors at 432 Park are also filled with equipment dedicated to managing water pressure on higher floors, equipment which is necessary in part due to the height added by the equipment itself. Thus, the increase in scale of mechanical systems leads to more mechanical-only floors, thereby increasing the height of the building, which in turn requires even more aggressive HVAC, and so on and so forth — these various mechanical systems as, perhaps, the feathers being singed as the towers climb higher. Alas, the design creates a feedback loop seemingly representative of the capacity for capital investments to distort and expand energy use with no regard for socio-ecological costs.<sup>2</sup>

The second trick developers use to manipulate building codes and allow for these supertall towers leverages the bureaucratic invisibility of uninhabited floors to address some of the

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- 1 Oliver Wainwright, “Super-Tall, Super-Skinny, Super-Expensive: The ‘Pencil Towers’ of New York’s Super-Rich,” *The Guardian*, February 5, 2019, <https://www.theguardian.com/cities/2019/feb/05/super-tall-super-skinny-super-expensive-the-pencil-towers-of-new-yorks-super-rich>.
  - 2 Michael Kimmelman, “Critic’s Notebook: The Hidden Feats That Built New York’s Towering Skyscrapers,” *The New York Times*, April 29, 2020, <https://www.nytimes.com/2020/04/29/arts/design/new-york-virtual-tour-virus.html>.

engineering challenges of supertalls. At 432 Park, for example, there are a number of “empty” floors, areas in which the concrete grid of the tower is left open. This element of the design reduces the potential for uncomfortable sway of the building by allowing air to flow through while simultaneously making the building taller. Similarly, the building contains a number of “sloshing dampers,” tanks filled with water that compensate for some of the sway caused by high wind speeds. The dampers are installed on mechanical floors, thereby creating additional height and contributing to the feedback loop.

As a recent article in *The New York Times* explores, however, these dampening measures, while successful in adding to the height of the building, have not been adequate in addressing the other challenges of the supertall structure. Informed by interviews with residents at 432 Park, the article exposes structural, mechanical, and social inadequacies, including water-pressure challenges that have led to a number of burst pipes and water damage as well as the fact that at high wind speeds, the towers emit otherworldly creaking noises.<sup>3</sup> Further, as the article described, the supertall elevator is prone to malfunction, in one case trapping residents inside for ninety minutes while the building swayed. These problems have led to suits and counter-suits as the super-rich engage in legal fights to preserve the value of their multi-million-dollar condos. As one resident told the *Times*, “everybody hates each other here.”<sup>4</sup>

The article also notes that the yearly maintenance costs for a typical condo at 432 Park exceeds the median annual income of residents in the Bronx, just a few miles north. In this sense, and especially due to their sparse occupation, the supertalls are not residential towers so much as monuments to the inequitable accumulation of capital, extreme versions of the growing category of a building or a home as an asset rather than a residence.

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3 Stefanos Chen, “The Downside to Life in a Supertall Tower: Leaks, Creaks, Breaks,” *The New York Times*, February 5, 2021, <https://www.nytimes.com/2021/02/03/realestate/luxury-high-rise-432-park.html>.

4 Sarina Abramovich, quoted in *ibid.*

One thinks again of Icarus, his glee at his capacity to fly, his apparent inability to exercise caution or concern about himself or others as he kept climbing higher.

In a somewhat perplexing outburst of dissatisfaction, another frustrated resident interviewed by *The Times* expressed her regret at buying her condo as a second home: “everything here was camouflage.”<sup>5</sup> What looked like wings, tools for a remarkable new experience, were just wax and feathers. An illusion. But, at the tower, what is camouflage for what? What is being hidden, and what does it blend into? On one level, the resident may be subtly referring to the building code tricks, shell companies, and other feints that provide the tower with its financial logic. Like so many other late-capitalist games, the supertalls operate as money laundering systems that allow the ultra-rich to park their excess profits in real estate while minimizing taxation and other so-called burdens. After all, these and many other large-scale projects rely on such investments. The development process is rooted in a financial logic reliant on excess. Architecture is here deployed to maximize novelty, through ornament, luxury, mechanical conditioning, and height, as an instrument and expression of excess with zero incentive for energy efficiency, affordability, or attention to social costs.

What is especially suggestive, in the context of solarly and relative to these supertall towers, are the precise terms of that excess. Luxury and exclusivity here, are expressed in height, proximity to the sun. And yet, the technical capacity to reach that height is served by a dramatic increase in mechanical conditioning and carbon emissions. In this sense, the towers express, at least in a schematic, diagrammatic fashion, a more general condition as architectural concepts of value and innovation are caught up in the priorities of capital, making them

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5 Sarina Abramovich, quoted in *ibid.*; also quoted in Victoria Bekiempis, “High Anxiety: Super-Rich Find Supertall Skyscraper an Uncomfortable Perch,” *The Guardian*, February 7, 2021, <https://www.theguardian.com/artanddesign/2021/feb/07/supertall-skyscraper-new-york-432-park-avenue-rich>.

difficult to align with the capacity for solar liberation. Ambitions are caught up in hubris and illusion, while the labyrinth of redistributing resources, reimagining futures, is darkened by these pencil thin shadows.

This schematic structure, both material and psycho-social, recalls Amitav Ghosh's scathing rebuke of contemporary culture captured in his 2016 title *The Great Derangement: Climate Change and the Unthinkable*. In this now familiar critical analysis, Ghosh acknowledges that buildings are one potent symptom of a larger cultural myopia, an inability, at least amongst some professions, to adjust methods and ambitions beyond the status quo. Ghosh writes, "if contemporary trends in architecture, even in this period of accelerating carbon emissions, favor shiny, glass-and-metal-plated towers, do we not have to ask, What are the patterns of desire that are fed by these gestures?"<sup>6</sup> Perhaps the most obvious answer to Ghosh's question is that the desire being fed is for wealth accumulation, at all costs. Disciplinary questions of value and metrics, the terms which frame and identify "design excellence" in architectural commissions, prizes, and exhibitions, collapse in the shadow of this reality.

Keeping Ghosh's critique in view, literary repurposing of the skyscraper suggests a few other directions for considering the inherent hubris of the supertalls. In the London of 2136 depicted in William Gibson's *Jackpot Trilogy*, for instance, supertall skyscrapers, though not quite as tall as 432 Park, are arranged in a grid of "Shards." Though habitable, these structures serve the primary purpose of scrubbing the carbon out of the atmosphere by virtue of a technology not clearly described.<sup>7</sup> Looking up at them, one character asks: "Carbon capture?" Another responds: "Those two store energy from renewables. I think they have molten silicon cores."<sup>8</sup>

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6 Amitav Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (Chicago: University of Chicago Press, 2016).

7 William Gibson, *The Peripheral* (New York: Penguin Books, 2014).

8 William Gibson, *Agency* (New York: Penguin Books, 2020).

As with much in these novels, and in Gibson's oeuvre more generally, there is a tether to the more familiar present. Not only does the author persistently reference techno-mythologies of carbon capture suggestive of a realm of techno-fixes familiar to the climate change debate, but he also tethers the buildings themselves to present day structures. The Shards, for example, are based on a recently erected building in London. Completed in 2012 and designed by Renzo Piano, the skinny pyramid-like glass tower is, as of this writing, the tallest building in the United Kingdom. It was the tallest in the EU before Brexit, but a Foster and Partners tower in Poland will soon exceed it. The Shard is a commercial building, unlike the pencil towers in Manhattan, and has taken its appellation from a criticism levied by the heritage approval board. The board claimed that the structure's reflective, sharp profile would be "a shard of glass through the heart of historic London," a derisive critique that has been embraced, not only for the building, but also the mixed-use development extending from its base, called the Shard Quarter.<sup>9</sup> The quasi pyramidal Shard, unlike Piano's early experiments with exposed infrastructure at the Centre Pompidou with Richard Rogers, does not consider the solar exposure of the elongated face as a space for absorbing radiation, for working with the sun. Instead, it is a bulwark against it, as at the supertalls: a sealed edifice built to keep the sun out rather than to engage or redirect its power for social benefit.

In his novels, published in 2014 and 2020 with the third installment forthcoming, Gibson's repurposing of the Shard is suggestive of a possible redemption for the pencil towers, albeit a fictional one. Likewise, other speculative fiction writers with an interest in both the material and symbolism of the built environment have seen similar opportunities for broad socio-cultural negotiations regarding the bottleneck of carbon accumu-

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9 Ellie McKinnel, "The Story behind the Design of 'The Shard' and the Surprising Way It Got Its Name," *My London*, May 18, 2020, <https://www.mylondon.news/news/zone-1-news/story-behind-design-shard-surprising-18268813>.

lation. Kim Stanley Robinson's waterproof, structurally sound carbon plating in *New York 2140* gives up the game. In the aftermath of the epochal flooding of lower Manhattan, Robinson's fictional technological solution allows for a cultural renaissance to commence rather than the structural and social disaster such an event would no doubt augur. The ending of Robinson's novel, in which the financier class embraces the politics of the collective, parallels this techno-architectural fantasy offering a different sort of camouflage, a speculative technology amidst the social effects that hide its impracticality.<sup>10</sup>

Paulo Bacigalupi offers a different model of the future in *The Water Knife*. Unlike Robinson's, Bacigalupi's novel is awash in the ambiguities and contradictions of contemporary life and its extension into numerous possible futures. Amidst pitched battles over water in the American southwest, Bacigalupi imagines the use of "Arcologies" as the space of salvation, which in this case takes the form of a repository for Chinese investment that allows for comfortable inhabitation within the harsh sun and scant water of the climate changed desert.<sup>11</sup> Bacigalupi's term, "Arcology," combining "architecture" and "ecology," was coined by Italian-American architect Paolo Soleri in the 1960s as a means to frame possible architectures of the present and future. Arcologies are built ecological systems with no determinate shape. Though they are often imagined as built into or emerging out of the ground, they focus on structural efficiencies, the selective use of thermal mass, recycling of water, and generally minimizing mechanical systems. In Soleri's own work, most arcologies were drawn rather than built, with the important exception of Arcosanti, an experiment in communal living Soleri and his acolytes initiated in 1971 in the desert outside of Phoenix.<sup>12</sup>

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10 Kim Stanley Robinson, *New York 2140* (New York: Orbit Books, 2014).

11 Paulo Bacigalupi, *The Water Knife* (New York: Alfred A. Knopf, 2015).

12 Paulo Soleri, *Arcology: The City in the Image of Man* (Cambridge: MIT Press, 1969).



In Bacigalupi's near future version, Arcologies are a beacon of hope funded by Chinese capital amidst a collapsing US economy. Their materials mitigate the overheated desert and the careful and performative reuse of water. This involves a complex recycling system as an atrium waterfall that itself plays a role in the narrative and stands counter to the ongoing drought and resultant social devastation of the world outside. The Arcology of Bacigalupi's world shapes the patterns of desire of the distraught citizens, eager to gain access to the lifestyle these architectural techno-fixes allow. Exclusivity is the accompaniment to technology.

Bacigalupi's positing of an inside and outside, of who is allowed in and who is kept out, and of the role of capital accumulation in structuring both the built environment and the terms of the social environment, brings us back to the pencil towers and their infractions. And to solarity: to the prospects for life under a different relationship to the sun. What the supertalls represent, in the end, in addition to absurd levels of wealth, is the apex, one hopes, of the imbalance of that relationship, a reach toward the sun that simultaneously aims to keep it out by sealed windows and excessive HVAC. Despite their height, the supertalls blend into the development imperative of finance and hedge funds, yet they stick out when seen in relation to the searing and growing need to reimagine the terms of innovation in the built environment within the context of a new sort of life with the sun.

A new understanding of innovations in architecture are being valued differently today as they resonate across social and ecological conditions. Structural and mechanical conditioning extremes for the super-rich may be less important than focusing research and capital on recycling water, upcycling materials, and other technologies of horizontal distribution. If we are to emulate Icarus's overreach, perhaps we can do so by absorbing solar radiation rather than reaching so high — through unbuilding, rebuilding, retrofitting, retooling, rebooting.

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## Landfill

*Bob Johnson*

The sun falls unjudging on all things alike.<sup>1</sup>

Apex Landfill. Las Vegas, Nevada. 2021.

A rotted head of lettuce. Flies and larva. An old leather couch. Cowskin withered in the desert sun. Razors, rubber duckies, nickel-cadmium batteries, toenail clippings, old receipts, scraps of bone, a toothbrush. This admixture of humanity's health and decrepitude, its aspirations and miseries, its kindnesses and crimes, tossed together without distinction under the fat heat of a Nevada summer.

All things mingled in the garbage heap — rich and poor, high and low, garish and austere. Yet solarity shines even here without pretense.

*To understand this.*

*To penetrate this secret.*

*This mountain... unconcealed...*

*unique cultural deposit,*

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<sup>1</sup> Jane Bennett, "The Solar Judgment of Whitman," in *A Political Companion to Whitman*, ed. John E. Seery (Lexington: University Press of Kentucky, 2011), 132.

*fifty million tons...  
carved and modeled.<sup>2</sup>*

This euphemism for the stinking remains of ourselves, for the discarded externalities of life, for the wreckage of material circulation and accumulation, the landfill is the proper place to begin an Elemental Solarity. For here in Nevada, outside of Las Vegas, we look out on the world's largest landfill by size, 2200 acres, 50 million tons of garbage, 9000 more tons with each cycle of the sun, being *tiered and layered like a sheet cake*,<sup>3</sup> this vast repository of capital's drive, its expenditure and its exhaustion, its excess that can't be contained, bound, or narrated within modernity's oily terms. Here, looking out on this gargantuan sacrifice zone, capital's empty claims to its ascendance over the natural world and liberalism's paeons to itself unravel like the spooling yarns they are.

*How clean the sun when seen in its idea,  
Washed in the remotest cleanliness of heaven  
That has expelled us and our images.<sup>4</sup>*

The landfill returns us, in other words, to a bold facticity, to sights, smells, and sounds that restore the senses, to the physicality of the real in full exposure, unsorted again, sprawled out in the rays of the sun without symbolic cover. At least for a moment nothing is concealed from us. At least for a moment, before the bulldozer arrives to cover it up again with autofluff, the sort of linguistic and literal incinerators we depend upon to sanitize the world are held at bay and the dwarf stars we orbit around — a constellation of false consciousness that speaks in free market exigencies, merit societies, austerity programs, eco-

2 Don DeLillo, *Underworld* (New York: Scribner, 1997), 185.

3 Stephanie Tavares, "Mountains of Garbage," *Las Vegas Sun*, December 7, 2009, <https://lasvegassun.com/news/2009/dec/07/mountains-garbage/>.

4 Wallace Stevens, "Notes Towards a Supreme Fiction," in *Wallace Stevens: Collected Poetry and Prose* (New York: Library of America, 1997), 329.

conomic externalities, liberalism, and enlightenment — these dim solar pretenders get blanched out in the incandescence of the sun.

There is no gaslighting in the landfill. Only sunlight.

So why an Elemental Solarity? And wherefore the landfill?

First, the analytic.

Elemental Solarity is a project of radical simplicity. The adjective in the phrase, elemental, refers us to the basic building blocks of life, to the objects around us, to the thingness of things, that is, both to the irreducible chemical elements that comprise life and to the social mattering of that life. In this respect, it points us to a new materialism that is more honest about the relationship between words and things, a materialism that better reckons with what Jennifer Gabrys calls the two classic directions of epistemology: knowledge as it derives from engagement with matter and matter as it is molded by engagement with knowledge regimes.<sup>5</sup> To be elemental is, in short, to see, touch, and feel the object-world anew and to pause before we start to speak again. As for the noun in the phrase, solarity implies a radical *exposure* to the thingness of this world, to its materiality, out of shadow, where we appear with our eyes wide open to see commingled together not only the exhilarating jouissance that characterizes some people's lives today but also the terrifying wreckage that others experience in this thoroughly capitalized and commercialized way of living. In this second sense, the solar analytic gestures towards restoring solidarities to each other, to nature, and ultimately to the facts around us. But to get there, it first must expose liberalism's failed epistemologies by candidly confronting its refuse, its redacted realities, its deferred limits, and its dead ends. Only then can we return to a solar economy that was there in the beginning and that is still waiting to be put to new purposes and to new ends.

The landfill is the obvious place to begin this analytical work of recovery. It is what Joshua Reno calls the "constitutive

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5 Jennifer Gabrys, Gay Hawkins, and Mike Michael, *Accumulation: The Material Politics of Plastic* (London: Routledge, 2015), 7.

absence” of modernity — the gap, the lacuna, the interstice, the repressed ID — where the modern world appears for a minute unnatural, unfamiliar, strange, and new again, before the work of narrative erasure begins.<sup>6</sup> The landfill is, in other words, the place where the energypower of modern life turns back on itself, to quote Dominic Boyer, where the unceasing drive to bring fossil fuels to bear on work, to absorb all life into the logic of commercialized production and consumption, spins out into undifferentiated waste, inefficiency, and renewed possibility.<sup>7</sup> To really see, smell, touch, and hear without defense or preoccupation — to be present here for a moment — is to come to know ourselves outside the circuitry of market exchanges, outside the platitudes of liberal political economy, and outside the murmurings from the husks of hollow men who speak only of progress, growth, and the satisfaction of yielding to capital.

To be present here is to expose the quandaries of a lazy liberalism that falsifies reality and keeps us in shadow.

### Quandary 1: Objects

The landfill does liberalism’s work by concealing the detritus of fossil capital, shuttling away the sinister material entropy that liberalism seeks to give ideological cover to. Solarity, in contrast, returns our attention to these discards, to the margins, the misfits, and the anomalies that keep piling up, waiting to be reintegrated into our world.

Let us be proper about the phrasing.

The *sanitary* landfill, for that is its euphemism, performs the work of erasure, repression, and denial. It tidies up the messy material world of unregulated fossil capital by performing four key functions that make its dominant ideology appear palatable to us. It functions to *spatially* relocate the offal that capital gen-

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6 Joshua Reno, *Waste Away: Working and Living with a North American Landfill* (Berkeley: University of California Press, 2016), 7.

7 Dominic Boyer, *Energotronics: Wind and Power in the Anthropocene* (Durham: Duke University Press, 2019), 5.

erates offsite, to socially remove capital's uncomfortable smells and textures beyond the senses of the world's privileged actors, to *psychologically* bury capital's most traumatic residue in an unreachable unconscious, and to symbolically render what we so generously call fossil capital's externalities unavailable to us for narration.<sup>8</sup>

But to arrive here by way of an Elemental Solarity is something quite different.

Solarity recovers the thingness of these many discarded things that can still be seen, touched, and smelled but that resurface in this other place outside of ideology. Splayed out in the sun, we see here *every kind of used and lost and eroded object of desire*<sup>9</sup> resisting the script that capital initially intended. Beyond the official chain of circulation, these objects no longer appear as fetishized commodities meant to string us along in this oily system but rather as the be-slimed and fractured traces of a system of maldistributed joys and pains that even seventy years later we still struggle to properly name. The plushness of a teddy bear tossed into the trash bin, its fluffy acrylic polymers still intact, juxtaposed now to this hypodermic needle with its residue of opioid, factory-produced steel and polymer palliative—these physical testaments to both lost innocence and human traumas generated by a system that does not live up to its promises. Is this the material evidence of a just process of circulation, of a righteous system of extraction, production, distribution, and political economy that doles out joy and effort in fair shares, that answers to who we really are? Or are they signs of something else?

The landfill, in other words, performs the messy removals needed to uphold the impression that everything is as it should be, that everything is in its place. It gives to the bourgeoisie's project the appearance of plausibility. But under the exposure of the sun, all of these little fractured objects reemerge as what

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8 Peter Stallybrass and Allon White, *The Politics and Poetics of Transgression* (Ithaca: Cornell University Press 1986), 3.

9 DeLillo, *Underworld*, 185.

they are, that is, the entropy of human ecstasy, injury, and waste generated by the fracking of life under this oily form of late capital.

### Quandary 2: Time

The landfill performs a second function by subsuming history into the homogeneous time of late capital, by compressing the past, present, and future into a liberal timeline that always already relates the same story of a world moving forward with opportunities limitlessly expanding and with eyes always focused on the future, oblivious to what has been left in the wake. Solarity sees something different in these traces of the past. It sees the “polychronic nature” of time, in Reno’s apt phrasing, the multitude of temporalities, human and nonhuman, that have been tossed aside in order to keep the story straight.<sup>10</sup>

The landfill works, that is, like a perpetual motion machine, to bury deep in the ground not only objects but also the discarded vestiges of time. It operates, quite literally, twenty-four hours a day, seven days a week, 365 days a year to redact our history and to persuade us into believing that life under capital proceeds neatly as if by nature through one timeless process beginning in extraction with mining and tilling the earth and proceeding through production, growth, and consumption only to end in a final and tidy burial as refuse. But this temporal work of the landfill is just a Herculean project aimed at containing what Walter Benjamin once called the *catastrophe of time, the piling wreckage, historical debris growing skyward* that capital has left behind, sometimes in objects, for us to sort through.<sup>11</sup> To the extent that the landfill serves to facilitate the impression of homogeneous time, it reinforces what petrogeographer Matthew Huber calls the subsumption of life under capital, reducing

10 Joshua Reno, “The Time of Landfills,” *Discard Studies*, September 25, 2015, <https://discardstudies.com/2015/09/25/the-time-of-landfills/>.

11 Walter Benjamin, “Theses on the Philosophy of History,” in *Illuminations: Essays and Reflections*, ed. Hannah Arendt, trans. Harry Zohn (New York: Schocken Books, 1968), 257.



even our history to something that merely reflects its transactional nature.<sup>12</sup>

Solarity, when it shines upon the landfill, sees instead a reservoir of alternative genealogies that are always resurfacing like the proverbial rubber tire that keeps the sanitary engineer awake at night. Solarity awakens the dead. It exposes, unburies, and emancipates again these lost timelines, both human and nonhuman. A stool with a leg gone missing that stinks of cheap bourbon, a stained apron from the local diner, and a splintered police baton with scratches and residual DNA. These radiate into the future the collective and individual human histories that were never really contained by capital and never merely transactional in the first place. They are a material resource that speaks to the experiential time of real people, of personal histories, and of collective stories that can't be contained by liberalism's script. These objects when exposed to the sun no longer promote the claim that we are being emancipated through free markets and private property. But so too this debris carries with it "natural" histories beyond people's cognizance, nonhuman histories tied up in biology, chemistry, and ecology that can't be subsumed by capital either. This bread festering in the sun with flies propagating, maggots growing and proteins, lipids, and polysaccharides breaking into their constituent chemical parts on nature's own timeline. When tuned to the solar analytic, we learn to watch more patiently as these things get reanimated by unplanned agents, by atmospheric, lithospheric, and ecological pressures that have as many designs for them as does capital.<sup>13</sup> For here the world's elements are not really being put to rest so much as they are being reassembled on new timelines in this unlikely place of propagation, where cadmium, carbon, and nickel get layered into the ground, where plastic bags get carried off by crows, where decomposition gives way to methane, and where

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12 Matthew Huber, *Lifeblood: Oil, Freedom, and the Material Forces of Capital* (Minneapolis: University of Minnesota Press, 2013), xix.

13 Reno, "The Time of Landfills."

things sit under the sun decomposing and rebirthing oblivious to bourgeois time.

The landfill might try to police the temporal borders of the liberal project by ensuring that time's evidence stays within the proper plastic lining, but the sun relentlessly exposes its well-kept secret that capitalism does not know where it comes from and cannot tell us where it is going.

### Quandary 3: Society

The landfill serves a third, and obviously related, function by erasing the evidence of social stratification which the liberal paradigm intentionally or unconsciously blinds itself to. By reducing all things to sameness, by reclassifying everything as either valuable commodity or worthless junk, the landfill operates much like liberal ideology to neutralize the uneven histories of systemic class, racial, and gender inequality that, in this case, are still being carried forward in these objects spread around us. The solar analytic by contrast sees in the landfill not so much garbage as a macabre mausoleum dedicated to the stratification of life under late capital.

The landfill operates by abstraction, by flattening the language we have for recognizing difference. In this case, everything becomes just trash to us, garbage headed into a common pit, the end point of a life immersed in capital where all things can only be either this or that and nothing in between. But the garbage that is heaping upwards and sinking downwards in the sun is a reflection of society. It is heterogeneous, stratified, and incommensurate. Just as a used battery tossed into the pit bears little resemblance to the tamale husk that sits beside it and just as the high-priced lobster tail has a different genealogy than the lowly potato, these artifacts of inequality and degradation are always being reduced in the landfill to this one terminal and muted thing we call waste, thus silencing the social life of these objects that were never adequately measured in capital's universal currency.

But solarity restores to the world the difference and differentiation that can be seen in these objects. It looks out not merely on trash but on the vestiges of human lives produced and spit out by late capital. This tarnished hubcap from a Mercedes Benz next to this sooty lawnmower are not merely garbage in the sun but the relics of gated communities and manual laborers, of racial powers and racial servitudes, of class protections and class exposures to the sun: these are the remnants of capital's logic of extraction and accumulation. Or perhaps it is this KFC wrapper next to this discarded and now-rotting remains of a sea bass, imported, filleted, and stripped to the bone for paying tourists in this city, a small reminder of those who labor and those who get to consume the fruits of that labor. Perhaps solarity even shines down on this discarded condom, drying up in the sun, a withered prophylactic that could mean so many different things in this commercialized city of easy marriage and prostitution where even bodies are used as commodities. And, yet, if the landfill, like its liberal owners, works by airbrushing and scenting the unwanted objects of misery and discord around us, solarity demystifies these mystifications, shining light back on the lost signifiers once ejected from the language of the bourgeoisie but still here to be reckoned with.

That is to say, the landfill transmutes into trash the traces of class crimes, racial abuses, and gender inequalities, but these overflowing bins of waste and shame wait to be dug up, uncovered, unearthed, and brought back under solar management. Resilient, they persist as the resources for something new, horizontal, and nonviolent when the sun is once again permitted to shine on them.

#### Quandary 4: Nature

Lastly, the landfill upholds liberalism's foundational, and most problematic, claim, its grandest gesture that says man stands in ascent over nature looking down on these things beneath us. The landfill materializes an enlightenment mythology that would have us somehow extracted from this object-world laid

out before us. But the solar analytic sees in these discarded “things” not the rent fabric of life nor does it accept a lazy dialectic that would split the world between us and our objects, between humans and nature. Rather it sees spread out before us this colorful tapestry of neglected kinships, discarded alliances, and excommunicated identities that bring us down to earth, that offer up new resources, and that take us out of the shadow we labor in.

For some time now, the landfill, not only this one but every other one, has waylaid life’s generative chaos by enabling a thick, if false, claim that we stand above the fray of the world, that human Reason and Capital *act upon* this world rather than *through* it. The landfill’s omissions, erasures, and removals on behalf of late capital function to promote a prevailing belief that we are realigning nature, as if by an invisible hand, into something better. But the comfort we get in that faith comes with strict prohibitions and taboos that distort what we see here and deny what we are. If there is one thing the landfill demands of us, it is that we repudiate this junk as not being part of ourselves, that we deny in an infinite number of refusals during every minute of every day the reality staring back at us here that the iron in this tossed-out, cast-iron skillet is the same iron in our blood, that the sucrose dripping from this bottle of Pepsi is already in our veins, that the carbon dioxide released from this decaying carcass is soon to be part of the plants we ingest, and that this methane drifting into the atmosphere is the composition of the air we breathe. Is it really possible, as we have been told, that this landfill will take whatever we choose to eject from our lives, whatever we rend from the fabric of life to call contamination, for 300 more years?

Solarity proposes something different. It refuses to see this garbage as *other*, instead reclaiming these lost objects of our desire and distaste for their reintegration back into our life both literally and figuratively. It understands that bourgeois Reason can only work when it is able to cast out of itself what it can’t understand, only when it is able to reclassify as pollution what-

ever resists its models.<sup>14</sup> But solarity knows that sooner or later everything returns to its original contamination and that these provisional containers always break down sooner or later, that the plastic lining degrades, that the leachate seeps back into the ground, and that the sun resumes its business of decomposing the lines we have drawn around life. Solarity knows, in other words, that the landfill is an instrument of political ontology, that it takes its name and purpose after the Latin verb *disponere*, which announces that the business of the disposal site is “to divide,” “to arrange,” and “to place” life into acceptable categories for this oily form of capitalism and its ideologues. But is this how we want to say *I exist*?

The landfill, like the bourgeois project, supposes that sentience puts us beyond the laws of nature, but an Elemental Solarity knows that a true materialism cannot cast things beyond the logic of the sun.

For now, however...

*the garbage keeps coming, the garbage keeps coming.*<sup>15</sup>

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14 Mary Douglas, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (London: Routledge, 1984).

15 Reno, *Waste Away*, 5.

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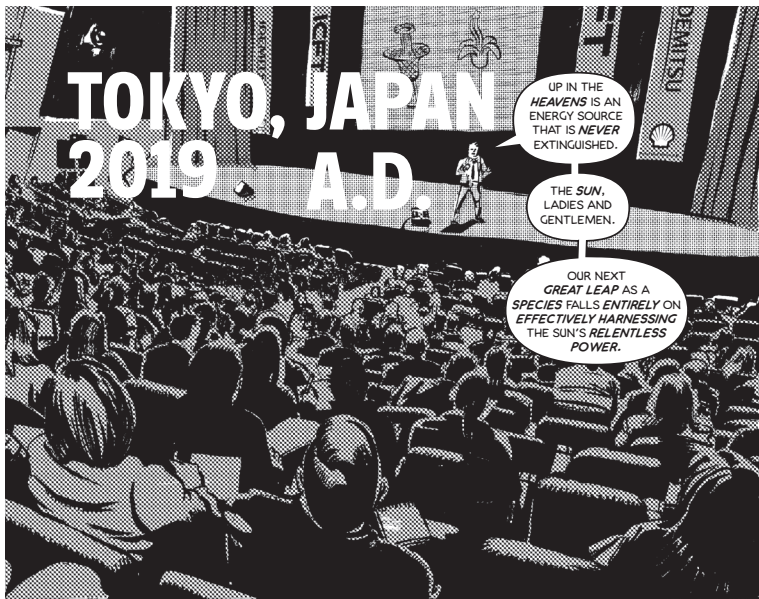
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## The Solar Grid (excerpt)

*Ganzeer*

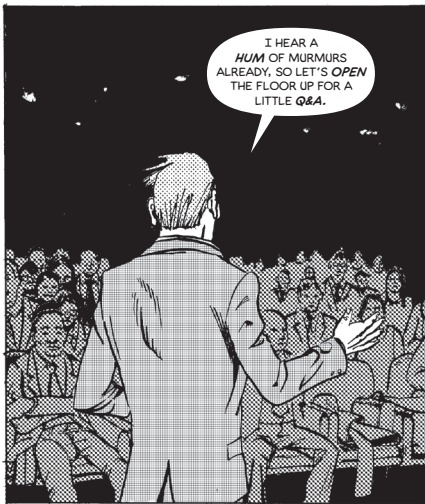
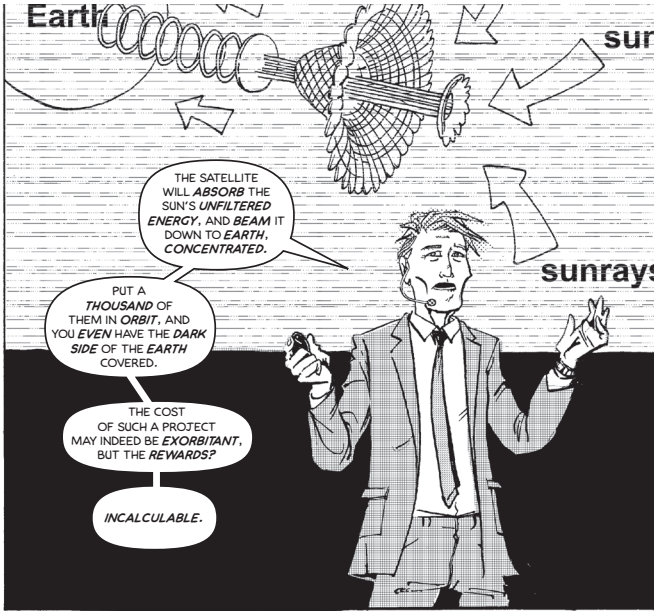






WITH A DESIGN INSPIRED BY NATURE HERSELF --LILIES IN PARTICULAR-- THIS GREAT COLOSSAL SATELLITE WILL HARNESS THE SUN'S POWER WHERE IT IS NEVER OBSCURED.

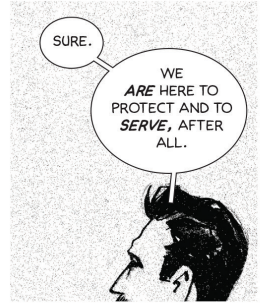






...

AMIN,  
BRING THE  
PRINCESS A NICE  
COMFY BLANKET,  
WILL YOU?



SURE.

WE  
ARE HERE TO  
PROTECT AND TO  
SERVE, AFTER  
ALL.

# CAIRO, EGYPT

## 9 A.F.\*

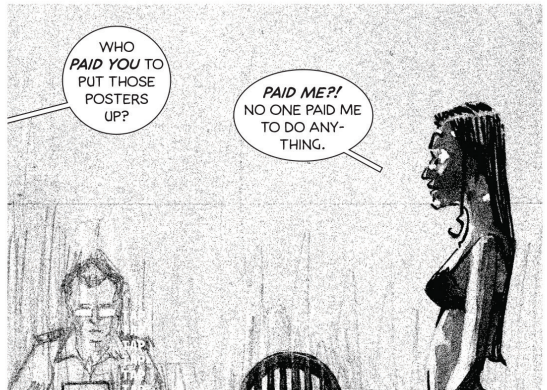
\*After the Flood



HEHE  
HEH...



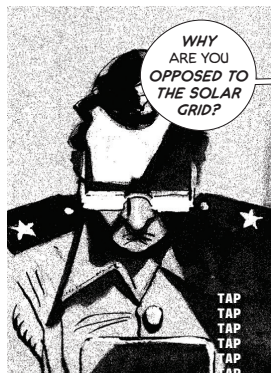
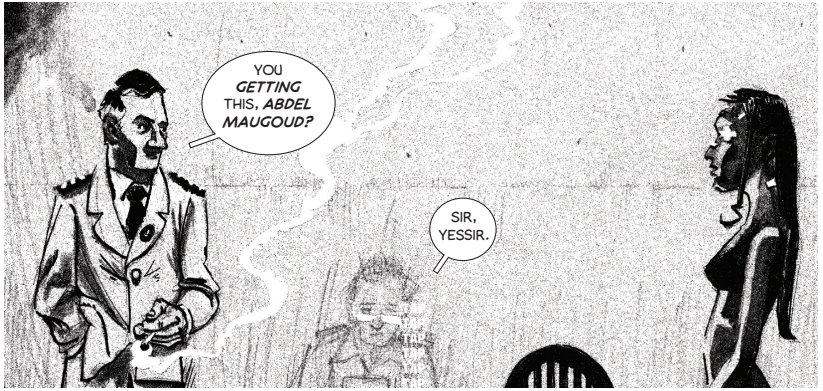
SO.



WHO  
PAID YOU TO  
PUT THOSE  
POSTERS  
UP?

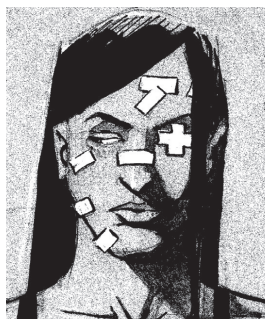
PAID ME?!  
NO ONE PAID ME  
TO DO ANY-  
THING.



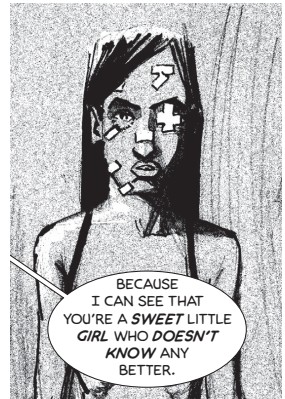
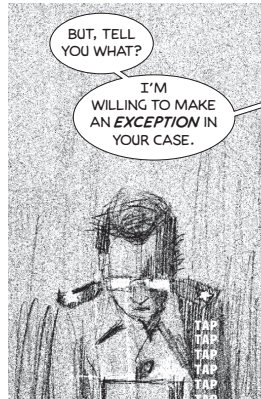
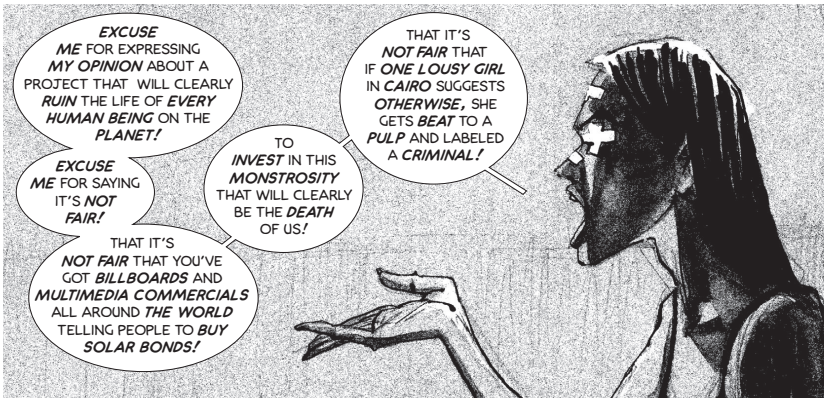




# RATTLERUMBLE







The Global

# GUARDIAN

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TUESDAY, JULY 13, 474 A.F.

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## America: "China's Apology is Not Enough."

### Unavoidable Conflict on the Horizon

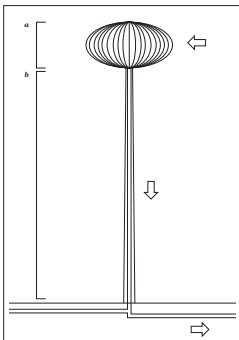
#### Deliberate Targeting of Mars Missions

By ALISSA SCHMITT  
and LIANG ZHANG

Washington — Significant groups in both China and the United States claim that a contest for supremacy between both countries is leading to an unavoidable conflict of massive proportions. As the U.S. is a leading member nation in the Federation of the Global North, and China has since been calling for a Coalition of the Global South, a conflict ignited by either state will surely dwarf any previous World War known to man.

Tensions between both nations have been increasing since a Chinese satellite collided with an American Mars-bound space shuttle. All 224 passengers were either killed upon impact, or flung out into deep space. The Chinese government released an official apology, claiming that its satellite moved into the shuttle's path as a result of an odd malfunction that could only be the result of a spy-hack gone wrong. The Chinese did not shy away from pointing fingers at Japan, which has denied all allegations. Intel however shows that Japan did attempt to hack into China's defense apparatus surrounding Miyako Island. It should be noted that China only made claim of the island a few decades following The Great Flood, and the United Nations has since issued multiple resolutions de-manding the Chinese return the island to Japan. China, however, has insisted that its expansion towards the island is a natural result of its population growth, and that the population decline of Japan suggests that the island is no longer necessary to the Japanese people.

U.S. officials, however, claim to



Leaked blueprints show Skyquench's plans to siphon produced water directly to Mars-affiliated spaceports.



Skyquench CEO, Sharif Algebr (right), with Mars representative Ivor Snowjin (left). [Kramer Weston / The Global Guardian]

# Skyquench is Stealing Your Water

### Classified Files Reveal the Company's Sinister Plans

By BUSTER BETHLEHEM

New York — A review of top secret documents suggests that water generated through Skyquench's much touted global program is destined for the colonies on Mars.

Skyquench's CEO, Sharif Algebr, has been in the mainstream limelight as of late, since signing an agreement with UN member states enabling his company to develop a series of towers across the planet to harvest clean water from the clouds. The project has been applauded by economists, arguing that not only would it afford an abundance of clean water, but it would also eliminate restrictions imposed on running the Solar Grid for more than 3 hours a day. While the Solar Grid may have helped re-

Little has been known, however, of Skyquench's intentions to connect its water-harvesting towers directly to spaceports operating launches to Mars. The Global Guardian has acquired top secret documents from a company insider who has chosen to remain anonymous for fear of repercussions. The documents reveal detailed schematics of major pipelines connecting Skyquench's towers to large-scale spaceports with potential for water storage capabilities. While the public has been generally positive about both The Solar Grid and Skyquench plans, it is questionable whether or not such sentiments will be retained with knowledge of their water going to other planets.

This information is extremely timely, as Mars predicts a sharp increase in popu-



“And we’re back. We’re celebrating Musk Day with our very special guest, Mr. Sharif Algebri, famed inventor and entrepreneur, founder and CEO of Skyquench, which hasn’t been without its fair share of controversy lately.”

“Mr. Algebri, you were just about to tell us why moving water off the planet is supposed to be a good idea?”

“Haha! You don’t mess around at all, do you, Jenna?”



“Okay, here’s the thing. Earth houses about 332.5 million cubic miles of water, the vast majority of which we do not use. Since the beginning of time to this very day, humanity has made use of no more than approximately 0.7% of that water.”

“Zero. Point. Seven Percent. That’s all the human race has ever needed. Now imagine if we were to double that quantity. We’d have more water than we could’ve ever dreamed of and it would still be no more than 1.5% of available water on the planet.”







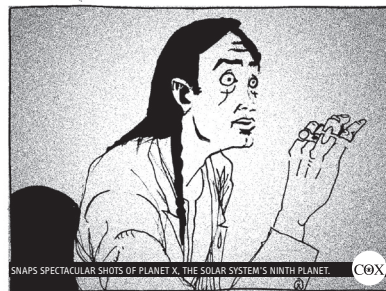
"Technically, there shouldn't even be a water crisis, but the only reason there is one is that we aren't utilizing the technologies available to us today."

"There's obviously the Solar Grid: a spectacular network of satellites that beam sun-rays onto the planet in the dead of night! Such power! And we only use it for what? 3 hours a night? It's been over 400 years since the flood and our solution to dealing with it is increasing daytime by a mere 3 hours? The Statue of Liberty is still under water for cryin' out loud!"



"I propose running the Grid for 6 hours. Or heck, all night if we have to. Sea levels would drop so fast, and all that water would evaporate into the atmosphere. And that is where Sky-quench comes in to harvest it all from the clouds."

"What that means is we could purify all 332.5 million cubic miles of water on the planet if we wanted to. Not only would there be enough water for both Earth and Mars, but for virtually every planet in the entire Solar System if we felt so inclined."



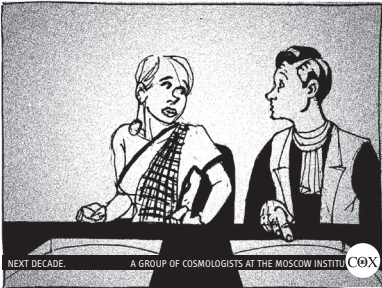


*"But... running the Solar Grid all night? The impact on the environment that would have... would be..."*

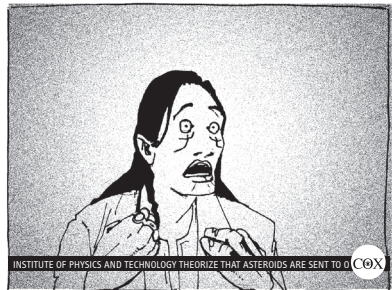
"The environment? Are you kidding me? Half the world is underwater, Jenna! We've already manipulated the environment beyond repair. What I am suggesting merely entails manipulating it to the advantage of the human race."

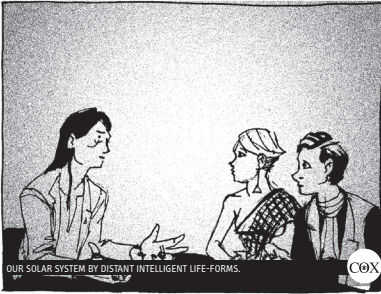


"Uh, Sharif. I'm gonna have to agree with Jenna on this one. I mean, don't get me wrong. I'm all for innovation, but we don't really know what kind of impact something like this would have on the planet, let alone on us. Y'know, higher probability of skin cancer maybe or God knows what else."



"We have the technology to deal with that, Jim, we have it. The fabrics they're developing now... you wear one of those Solar Suits out during Grid hours and you don't even notice its activated at all."





OUR SOLAR SYSTEM BY DISTANT INTELLIGENT LIFE-FORMS.

COX

*"What about Aquatic life?"*

"It would be at risk, that's true. But it's either that or putting the future of humanity at risk."

"..."

"Listen, we have an opportunity to finally create a utopia for all of humanity here. For one, we would have access to 24 hours of Solar energy. Free. Energy. Forever. You realize what that would do? End our energy crisis and more or less afford goods and services to every human being alive."



A RARE SPECIES OF FLAMINGO, THOUGHT ONLY TO EXIST IN TURKEY, HAS ALSO BEEN

COX



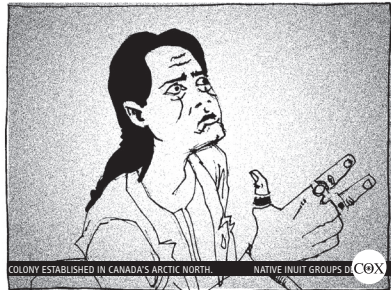
BEEN DISCOVERED IN GUATEMALA.

NEW SELF-GOVERNING ARTIST COLONY

COX

"Secondly, sea levels would decrease very rapidly. Which means more land. More farm land, even. Possibly enough to provide food for us, the colonies on the Moon, colonies on Mars, and maybe even Venus."

"Thirdly, enough fresh clean water for us here on Earth, and anywhere else in the entire Solar System. Probably till the end of time. What we have on our hands here is an equation for paradise."

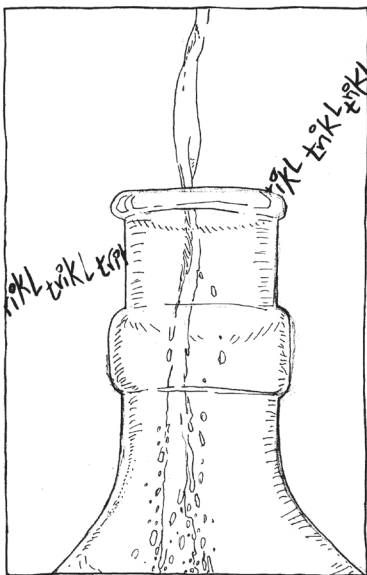
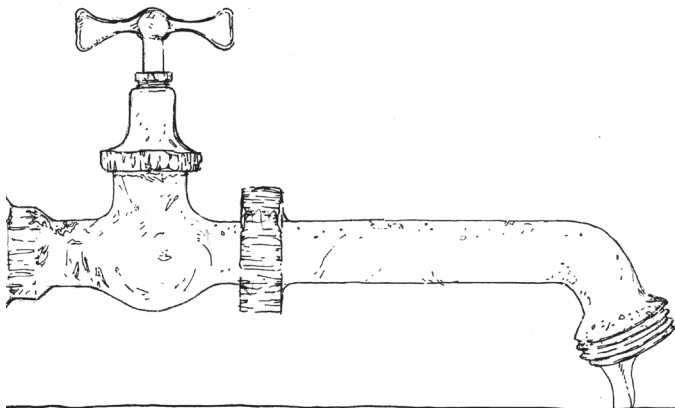


COLONY ESTABLISHED IN CANADA'S ARCTIC NORTH.

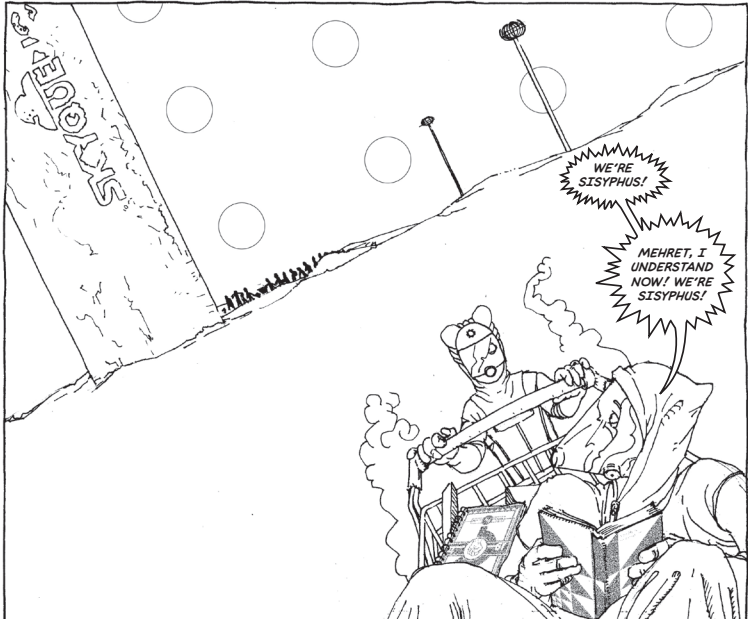
NATIVE INUIT GROUPS D.

COX

# 475 YEARS LATER









## The Ray and the Flame, or, What It Takes for the Sun to Shine

*Tim Ingold*

What does it take for the sun to shine in the sky? What does it mean to experience the brilliance of its light? You might think that these are entirely different questions, one inviting an answer in terms of the physics of radiation, the other in terms of the psychology of perception. I aim to show, to the contrary, that physics can no more account for sunshine than psychology for luminous experience. We shall see that these are not different questions but alternative versions of the same question — one which can be answered, however, only by repudiating the bifurcation between the two worlds, of matter and energy on the one hand, and of mind and meaning on the other, which has traditionally separated the disciplines of physics and psychology. For the light that shines belongs, in our experience, neither to the physical nor to the mental but, like the sky itself, to the phenomenal or atmospheric order of reality. It is an order constituted by the fusion of the cosmic sphere with the sphere of affect.<sup>1</sup>

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<sup>1</sup> I have developed this argument at greater length elsewhere. See Tim Ingold, *The Life of Lines* (London: Routledge, 2015), 94–100.

Physicists, of course, tell us that sunlight consists of electromagnetic emissions that, having travelled some 93 million miles through the void of space, eventually reach the surface of the earth, both catalyzing the photosynthetic reactions that fuel the growth of plants and triggering a response in the photoreceptive cells of those animals, including human beings, that are equipped with eyes. We see things, at least in daylight, thanks to this solar radiation, as it differentially rebounds from, or is absorbed by, the surfaces it encounters. But do we see the light itself? “Of all the things that can be seen,” asked the psychologist James Gibson in his pioneering work on the ecology of visual perception, “is light one of them?” It is not, he answered. We see the sun and the moon, the embers of the fire and the flame of the candle. But these, he insisted, are objects disclosed by the light; they are not light “as such.” Pared down to its radiant essence as waves or photons in a physical universe, light is the one thing we never see.<sup>2</sup>

What, then, are we to make of the varieties of luminous experience? They are surely real enough, and every language has a wealth of verbs with which to describe them. In English, for example, we have not only shining but also glowing, blazing, flickering, and many more. The sun shines; the fire blazes and its embers glow; the candleflame flickers. But radiant energy can do none of these things. If light consisted only of rays, then it could neither shine, nor glow, blaze or flicker. Yet for us, the shining of the sun, along with the blazing logs and glowing embers of the fire, and the flickering flame of the candle, is no illusion, no hallucination in the world of appearances. It is as real as is the pitch darkness of a stormy night. This is not to say that we are right and physics wrong, or vice versa. We and they can both be right, but only because we start with different definitions — respectively physical and phenomenal — of what light *is*. For physics, light is an energetic impulse of which our experiences are mere effects and induced in the theater of con-

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2 James J. Gibson, *The Ecological Approach to Visual Perception* (Hillsdale: Lawrence Erlbaum: 1986), 54–55.



sciousness. For us earthly beings, light is the experience itself for which radiant energy is but a condition.

What then must the sun be, for it to shine? It cannot be a distant cosmic object, or an emitter of rays. Shining does not connect me, by a long straight line of transmission, to the sun. It rather carries on, in real time, along an axis orthogonal to this line, an axis along which the sun and I measure out our days together. This is the temporal axis of sentient awareness in the midst of a world forever on the burn. As with the blaze of the woodfire or the flickering flame of candle, it is the sun's shining, rather than spanning an interval of transmission, that endures in the glare of combustion. For in our experience, the sun is its light, not a source of light, and in its shining, it erupts into a vision that, far from having closed itself off from a world "out there," has opened itself to the boundless sky. Thus, sunlight does not arrive from afar but ignites in the consciousness of the seer who sees with it, with eyes bathed in its luminosity. After all, as poet-scientist Johann Wolfgang von Goethe mused, "if the eye were not sun-like, the sun's light it would never see."<sup>3</sup>

Note that Goethe wonders how the eye sees the sun's *light*, not the sun as an *object* by way of its light. The sun is of course a star, and a telescope can detect the stars by their lights. But it does not see the light of the stars. Goethe wants us to compare the eye to the sun, not to a telescope. Its function is not to pick up energetic signals conveying information about distant objects, and to refer them to an interior mind-brain for processing. Our sun-like eyes, for Goethe, are not the organs of a body, nor does the comparison rest upon the spherical form of both the eyeballs and the sun. He sees in the eye, rather, the affective disposition of a body that, opening itself to the heavens, becomes a creature of the light. It is as though the body, satu-

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3 In the original German: "Wär nicht das Auge sonnenhaft, / Die Sonne könnte es nie erblicken" (from "Zahme Xenien III," 1827), cited in Frederick Amrine, "The Metamorphosis of the Scientist," in *Goethe's Way of Science: A Phenomenology of Nature*, eds. David Seamon and Arthur Zajonc (Albany: State University of New York Press, 1998), 34.

rated with light, were to become all eye — as though we were eye-bodies, not bodies with eyes. And it is to understand the sun likewise not as a celestial body — an *object* of vision to be seen, at best, through a glass, darkly — but as that which lights our existence and the world from within, on the hither side of vision. As the sun is its shining, so it shines in our own eyes.

For us humans, of course, sunlight not only illuminates our world, but it warms us too. So do, on a lesser scale, the flames of the fire. In the eyes of medieval people for whom the naked flame was far more central to both warmth and nocturnal illumination than for most of us today, light and combustion were inseparable. Wherever there was light, something was burning. The rising flames of a fire twist and curl in response to atmospheric conditions, much as do the trunks of trees, rising from the earth. The metaphor of the beam of light has its source in this comparison. The word referred originally to a living tree, a usage preserved in the names of such common arboreal species as whitebeam, hornbeam and quickbeam. The archetypal incendiary analogue of the tree-trunk was the Biblical *columna lucis*, the fiery “pillar of light” by which, in the Book of Exodus, the Israelites were guided on their way at night. And for the Venerable Bede, writing in the eighth century, the beam was the light or fire ascending from the body of a saint. Light *beams* from the saintly body, according to Bede, as the tree trunk grows from the earth.

Here, the beam was a flame. So, too, the thirteenth century painters who decorated the wooden ceiling of the stave-church of Ål, in central Norway, depicted sunbeams as flames, spewing out in all directions from a blazing solar fireball (fig. 1). Only later was the beam straightened. Eventually, it would refer to straight-cut timber, not the living tree; to the rectilinear ray and not the flame. The timber was felled, the flames extinguished, light dematerialized. The world was straightened out, geometrized. Yet radial geometry did not have to await the birth of physics, let alone the discovery of electromagnetic radiation. It was already there, in Ancient Greece, in the set-up by which a stake in the ground, rising erect like the gnomon of the sundial,



Fig. 1. The sun and the moon. Detail from a painting from the wooden ceiling of the stave-church of Ål, in central Norway, dating from the thirteenth century. Courtesy of the Museum of Cultural History, University of Oslo.

would cast its shadow by the sun's rays, allowing measurement by proportion. But in this setup, as philosopher Michel Serres remarks, "there is no place for the eye, nor site that can be called a point of view."<sup>4</sup> The sun alone disposes, leaving mortal eyes to pick out the forms of things from patterns in the light, while blind to the light itself.

In short, the ray is as distinct from the flame as emission from combustion. They rest, fundamentally, on wholly different ontologies of the sun and its light. As an emitter of rays, the sun is transcendental, master of the cosmos, invisibly disposing its visible objects according geometric laws. But as a beaming fireball, it is elemental, shining in the eyes and warming the hearts of all who are dazzled by its splendor. It is no wonder that throughout human history, those with aspirations to absolute power have sought to enlist the sun in their enterprise, or even to model their rule upon that of the sun itself. Yet none has managed to resolve the duality between the two suns, of geometry and of fire. The ruler who would order his kingdom according to principles of geometry, but who would also daz-

4 Michel Serres, *Geometry: The Third Book of Foundations*, trans. Randolph Burks (London: Bloomsbury, 2017), 139.



Fig. 2. Pachacuti, the ninth ruler of the Inca state, worshipping the sun-god Inti, at the temple of Coricancha. From the seventeenth-century chronicles of Martín de Murúa.

zle his subjects with the brilliance of his light, must command both. Perhaps that is why the sun-god Inti, worshipped by the rulers of the Inca people, is depicted as a golden disk radiating arms that are alternately wavy and straight (fig. 2). These are the arms of different suns, with different lights. The straight arms are rays, they ordain the order of the Inca state, with its straight roads radiating out from the capital, Cusco. With their sharp points, they pin the people to the land, each community in its appointed place. But the wavy arms are flames, sources of heat and vitality. With them, the sun-god wraps his devotees in the

warmth of his embrace. And as we go around the sun's disk, first the ray, and then the flame, is invoked.

In late medieval Europe, heraldic depictions of the "sun in splendor" adopted a similar solar imagery, again with an alternation of wavy and straight arms. Drawing on both Incan and European traditions, the same iconography is reproduced today in the national flags of Uruguay and Argentina. Each flag carries an image of the sun, known as the "Sun of May" in commemoration of the events of May 1810 that marked the beginning of independence from the Spanish Empire. The Uruguayan version has sixteen arms, and the Argentinian has thirty-two, but on both flags the arms are alternately straight and wavy: light as ray; light as flame. The straight lines order the universe, but it takes the wavy lines for the sun itself to shine. For to repeat, the sun in splendor is its shining, and it shines in our own eyes.

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## Tupilaq (In the Shadow of Solarity)

*Amanda Boetzkes*

We up here live two kinds of life, in the summer under the torch of the sun and in the winter under the scourge of the northern wind. But the cold and the darkness is what makes us think. And when the great darkness covers the land many hidden things are revealed and then the thoughts of human beings go along pathless ways.<sup>1</sup>

— East Greenlander, 1914

I position “solarity” here as one among many elemental agents that shape the cultural regimes of the circumpolar North. The concept of solarity tempts a line of theorization bound to a scientific perspective and its assumed position of objectivity, whereby the “solar” is defined as both the medium of scholarly insight (the source of illumination) and an energy resource (and therefore an object of study). I suggest that solarity is better understood through elemental philosophy and its commitment

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1 Merete Demant Jakobsen, *Shamanism: Traditional and Contemporary Approaches to the Master of Spirits and Healing* (New York: Berghahn Books, 1999), 45. Translation of an East Greenlander quoted in Anton Berthelsen, *Neuropatologiske Meddelelser fra Grønland II* (Copenhagen: Quist & Komp, 1914), 33.



*Fig. 1.* Whale Bone Arch, Barrow Alaska. Courtesy of the US Fish and Wildlife Service.

to thinking the irreducibility of elements in their overlap, complication and withdrawal from one another. This trajectory counteracts the technoscientific perspective at work in environmental archaeology with an understanding of solaricity as a force that vitalizes material culture through its interplay with other elements, its capacity to cast shadows, and the way it yields an account of artifacts beyond positivist narratives of culture and history. Here, the insights of solaricity come by way of an awareness of its interaction with the moon, the night, with bone and sinew, with land and water, tools and carvings, climate changes, human and animal migrations, and the forced displacement of the circumpolar Inuit.

### **Thule Remains under the Sun**

In Barrow, Alaska, the immense jawbone of a bowhead whale stands as a passage to the Arctic Ocean. Bleached white in the sun, the Whale Bone Arch is a monument to the Iñupiat (Inuit) people of Alaska whose history and contemporary livelihood



is bound to sea hunting (fig. 1). The jawbone is also an iconic structure of the Thule people, the ancestors of the circumpolar Inuit, who used whale skeletons as architectural supports for their coastal settlement homes. The Thule migrated eastward across the Arctic Archipelago from Siberia to Alaska, Nunavut, and across to Greenland during a period of climate warming that began around 1000 CE and lasted until the sixteenth century.

In environmental archaeology, weathered whalebone and other artifacts made of walrus and seal tusks, teeth, and skins are crucial objects for analyzing the cultural transformations of the Thule as they traveled across the circumpolar North. This early period of climate warming caused the breakup of glacier ice and a proliferation of Arctic waterways, which in turn led to the flourishing of open-sea hunting, the development of more complex harpoons and other tools, textiles, and architectural scaffolding that integrated the bones and teeth of sea mammals.<sup>2</sup> The jawbone in Barrow therefore corroborates the Thule's dynamic cultural ecology.

Using Optically Stimulated Luminescence (OSL) dating, environmental archaeologists analyze the sediment on these artifacts, gathering data about the Thule migration by assessing when the objects were last exposed to the sun. OSL dating situates the artifacts in the archaeological settlements based on their luminescence signal. Mineral grains that were attached to the objects acquired luminescence upon exposure to the ionizing radiation of the sun, which in turn effected the trapping of electrons. OSL provides an encompassing picture of the Thule's use and discard of objects and tools deduced from an analysis of their biochemical exchange with the sun. Yet while the OSL analysis of the objects informs a seemingly objective understanding of the Thule's relationship to the land, it never-

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2 See Robert W. Park, "Frozen Coasts and The Development of Inuit Culture in The North American Arctic," *Landscapes and Societies—Selected Cases*, eds. I. Peter Martini and Ward Chesworth (Dordrecht: Springer, 2010), 407–21.

theless leaves many questions unanswered regarding the Thule's understanding of the sun, moon and other elements, and how this informed the evolution of their flourishing material culture. In other words, the sun may illuminate and situate this historic culture from the perspective of environmental archaeology, but if understood as a medium of objectivity, it ultimately casts shadows over Thule historicity and its legacies in contemporary Inuit culture.

Among the remaining mysteries of Thule settlements is the question, why did they so readily choose whalebone and walrus ivory rather than the antler and bone of land mammals that were more readily available and more pliant? Archaeologist Robert McGhee suggests that Thule artifacts seemed to have been fabricated and grouped in consonance with the classic land-sea dichotomy elaborated by Marcel Mauss.<sup>3</sup> In the early twentieth century, Mauss noted that modern Inuit, the descendants of the Thule, did not mix cookware for caribou and sea mammal meat nor could caribou skin be sewn on the ice.<sup>4</sup> His influential study established a structuralist discourse of the mythological associations of land (as male) and sea (as female) along with seasonal changes in settlements in archaeology. Thus, McGhee proposes an extension of the land-sea dichotomy and its counterparts to other dichotomies such as man/woman, summer/winter and antler/ivory (land mammal/sea mammal) in interpreting Thule material culture. Ivory and whalebone became the material of choice for a culture that coevolved with the conditions of climate warming and correspondingly an increase in sea-hunting and northeasterly migration.

Yet, this structuralist framework does not account for its own overcoming as it is recounted in the mythology of the circumpolar Inuit. For example, the relationship between the moon (Moon Brother) and the sun (Sun Sister) is understood

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3 Robert McGhee, "Ivory for the Sea Woman: The Symbolic Attributes of a Prehistoric Technology," in *Interpreting Objects and Collections*, ed. Susan M. Pearce (New York: Routledge, 1994), 59–66.

4 Marcel Mauss, "Essai sur les variations saisonnières des sociétés eskimos," *L'Année Sociologique* 9 (1906): 39–130.

as polarized by an incest taboo. Arctic skies are animated by Moon Brother's drive to transgress, a desire that is fulfilled during the solar eclipse. The two siblings enliven the sky as a dynamic unity of opposites as Moon Brother chases Sun Sister across the celestial vault in search of sexual gratification. On the occasion of the solar eclipse, when volatile Moon Brother's passions override, and Sun Sister is overtaken by his advances, the entire order of Sila — the vital breath that binds all living things together — is threatened and might even induce a social panic.<sup>5</sup> Such violations of the dichotomous separation between moon and sun led to the ritual of the *illuminanganak qungaujaqpuq* ("paradoxical smile"), when people pretend to smile with half of their face upon the first appearance of the sun after the winter. The half-smile is meant to induce Sun Sister to shine brighter, as though she might think "since they are making fun of me, I'm going to shine my burning rays on them."<sup>6</sup> During the darkness of the polar night, women would play cat's cradle in order to catch the light of the sun in the game's crosstreads and prevent it from vanishing.

The solarity of the circumpolar Inuit appears in its radiations through its material culture, the interleaving of Sun Sister with other celestial bodies, affects, objects and beings. Yet an appreciation of the sun's elemental expressivity in Inuit myth does not often register in the archaeological accounts of Thule settlements. Instead, the Thule have been theorized straightforwardly in terms of the *effects* of sun exposure on their tools and objects rather than their meaningful co-implication. The sun is framed as a primary environmental cause of cultural change and is therefore an object and medium of analysis.

Under the sway of OSL dating, environmental archaeology focuses on the centuries-long time period after the fifteenth century when the Little Ice Age struck, and the Thule withdrew

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5 Bernard Saladin D'Anglure, *Inuit Stories of Being and Rebirth: Gender, Shamanism and the Third Sex* (Winnipeg: University of Manitoba Press, 2018), 99–100.

6 *Ibid.*, 100.

from the High Arctic and migrated south. It was during this time that the open water hunting season shortened, and the cooling climate became prohibitive for long-term habitation. The Thule disbanded, leaving their settlements, and abandoning their artifacts. As the land froze into an Arctic desert, the sun exerted itself on the bones, teeth, and skin that shaped the Thule settlements, consuming the fleshy residue of their sediment. Curiously, the desertion of the Arctic has become the condition of possibility to hinge the culture of the Thule and that of the contemporary Inuit in environmental archaeology. While they are defined as distinct peoples, it is assumed that the former are predecessors to the latter. The assumption of continuity is, however, argued through an environmental determinism, that climate change caused the migrations and technological evolution of the Thule. The centuries of nonhuman environmental activity between the sun and the artifacts when the high Arctic was uninhabited invited settler projections and intentions to the archaeological analysis. These projections should cue us to the risks of theorizing solarly as an exclusively environmental agent without the elemental mythologies that disclose its transgression of dichotomous relations. The scientific drive to purify the sun as a geophysical cause effaces the cultural complexities that illuminate the proliferation of the Thule into the heterogeneous peoples of the circumpolar North.

### **The Revitalization of Whalebone in Places Without Dawn**

In the late twentieth century, Thule whalebone artifacts became newly important to contemporary Inuit who started using the bleached whalebones from Thule settlements as a material for sculpture carving.<sup>7</sup> Whalebone acquired an added layer of signification when it entered a lucrative global art market. Not only was it an ideal material insofar as the Inuit found it pre-bleached and ready for use, but it conjoined their contemporary culture

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7 Susan Hallett, "Eskimo Sculpture: The Archaeology of Whale Bones in Art," *Canadian Review* 3, no. 4 (1976): 30–31.

to that of the Thule. Inuit sculpture therefore doubled as high art and ethnographic artifact, encompassing an archaic quality that appealed to southerners.<sup>8</sup> Whalebone sculpture indexed an ancient and exotic culture while feeding a belief that the Inuit were closer to nature. However, the discursive construction of a linear continuity between the Thule and the Inuit invited colonialist projections that framed both the Thule and the Inuit in primitivist terms.<sup>9</sup> Nineteenth-century anthropologists and archaeologists framed the Inuit as living examples of the “prehistoric” Thule who were unusually “adaptable” to harsh environmental conditions. These social sciences positioned the Inuit as an ancient culture lacking modern social organization and technology and at the same time as naturally possessing supreme skills to survive High Arctic environments.<sup>10</sup> The geocultural specificity of the whalebone was subsumed into a generalized narrative that effaced the Little Ice Age, the dispersal of the Thule, the southern migration that defined and differentiated the Inuit, and the centuries of exposure of the Thule artefacts to the sun over which time their meanings and uses lay dormant.

The archaeological discourse of the Inuit’s “environmental adaptability” was unattuned to the specific peaks and valleys of climate change in the High Arctic that had instigated the southern migration of the Thule. Indeed, the Inuit’s presumed “natural adaptability” to any Arctic environment was the pre-*tense* for the Canadian government to relocate the Inuit from the Subarctic regions of Hudson Bay hundreds of kilometers

8 Heather Iglioliorte, “Hooked Forever on Primitive Peoples’: James Houston and the Transformation of ‘Eskimo Handicrafts’ to Inuit Art,” in *Mapping Modernisms: Art, Indigeneity, Colonialism*, eds. Elizabeth Harney and Ruth Phillips (Durham: Duke University Press, 2019), 62–90.

9 Robert McGhee, “The Archaeological Construction of Aboriginality: The Inuit Case,” in *Archaeologies of Us and Them: Debating History, Heritage and Indigeneity*, eds. Charlotta Hillerdal, Anna Karlström, and Carl-Gösta Ojala (New York: Routledge, 2017): 97–108.

10 *Ibid.*, 99.

north to Resolute Bay and Grise Fiord in the 1950s.<sup>11</sup> The government promised them economic prosperity through better hunting opportunities, which they could purportedly optimize using their presumably inborn patterns of thought and reaction inherited from the Thule. The Inuit relocatees immediately contested the new conditions and accused the Canadian government of using them as human flagpoles to declare its sovereign claim on Arctic lands.<sup>12</sup> The relocation was both shockingly new and wholly traumatic in that it enforced the separation of families and communities from one another. While the government deployed the archaeological rationale to theorize the connection between the Thule and the Inuit to reinforce its military position, in fact centuries of climate cooling and an entirely different set of knowledge, resources and skills separated them. As Amy Prouty charts, the Inuktitut names given for these places by the relocatees disclose exactly how impoverished these environments were from their perspective: they named Grise Fiord *Ausuittuq*, “the place that never thaws,” while Resolute Bay was called *Qausuittuq*, “the place with no dawn.”<sup>13</sup>

Despite the government’s shameful misuse of archaeology, the Inuit discovered a use for the solarized Thule bones they found abandoned there, which became a preferred material of Inuit sculptors. While in the early twentieth century, Inuit carvers had primarily sculpted walrus ivory and soapstone, after the relocation, dozens of art cooperatives were formed in Nunavut, Québec, and the Northwest Territories, and Alaska and started selling whalebone sculpture. The cooperatives—among them the now famous Kinngait Co-Op (originally the West Baffin Eskimo Co-Operative)—functioned under the model of colonial trading posts. Though an affirmation of colonial economy, they nevertheless yielded an opportunity for hunters to earn

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11 Ibid.

12 Amy Prouty, “How Art Brought About an Apology for High Arctic Relocations,” *Inuit Art Quarterly*, June 18, 2020, <https://www.inuitartfoundation.org/iaq-online/how-art-brought-about-an-apology-for-high-arctic-relocations>.

13 Ibid.

extra income under the deprived conditions of forced resettlement. The cooperatives increased the southern market for Inuit whalebone sculpture to such an extent that whalebone started to be harvested for that express purpose.<sup>14</sup> Yet fresh, unbleached whalebone came with a set of challenges: it leaches strong-smelling oil and can even breed worms, sometimes decades after it has been sculpted, and the period of solar exposure had actually prepared the bones for Inuit sculpting. Moreover, by the 1980s, embargoes on whale products in Canada and the United States led to a decline in the exchange of new whalebone. Consequently, the renewed market value of sun-bleached Thule artifacts in and as a material for Inuit sculptures consolidated their history as inheritors of Thule land and culture. Nevertheless, this inheritance was predicated on a complex form of military, colonial, and scientific paternalism.

If whalebone sculpture acts as a suture between the Inuit and their Thule predecessors, then it also points to the gap between the two cultures and the centuries of time over which the whalebones lay discarded, exposed to the sun. For whalebone became informative as an artifact for archaeologists using OSL, and useful as a sculptural material due to a *discontinuity* between the Thule and the contemporary Inuit, a lapse in history over which time the sun exerted itself as an agent without narration or myth, while it leached the whalebone of its oil, sinew, and fleshy residue. This solar activity materialized the rupture of the artifacts from their cultural life and throws a geological lens on the history of the Inuit. The most meaningful solar activity in this context is, paradoxically, a time without human occupation in the area. It coincides with a time of climate cooling, when the High Arctic became inhospitable, when the whales departed and the Thule left their whalebone settlements, so that eventually when colonial expeditions arrived to rediscover the area, they could claim the land and its meaning for themselves as though for the first time.

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14 Susan W. Fair, *Alaska Native Art: Tradition, Innovation, Continuity*, ed. Jean Blodgett (Fairbanks: University of Alaska Press, 2006), 45.

## Recasting Colonial Shadows

What is solarity in this complex history of the circumpolar Inuit? The sun appears here as a two-fold force: the first, as one that conditions archaeological objects for scientific analysis in its weathering of human and nonhuman animal remains and second, as one that strips those same remains of their specificity in a cultural ecology, priming them to be recoded under the terms of settler epistemology. It is as though the sun fulfils an ideal of objectivity that is coextensively scientific and economic. It produces scientific information by consuming the fleshy layers that constitute the matter of diversity. But the solar consumption of bone is ambivalent. Did it enable the colonial resettlement of the Inuit by yielding Thule artifacts as a commodifiable material? Or was it an element that revitalized whalebone, charging modern Inuit sculptural practice with energies that allowed them to summon a Thule renaissance?

Read as a corrosive force that consumes organic matter, the sun's energies can efface differences in a totalizing way. Archaeology subtly deploys the sun to reduce the objects of the Thule assemblage to geological information, thereby it uses solarity as a controlled illumination. The use of OSL dating subtly divides the artifact between geology and culture in such a way as to mask their co-extensiveness. This application of solar light to produce a totalizing knowledge tempts a discourse of environmental adaptability with an impoverished understanding of cultural innovation as naturally occurring from set environmental conditions. It also leads to slippages and effacements of the climate events, political conflicts, and composite resolutions that animate the long history of the Inuit.

Read as an entangled energy, the solarity of Inuit sculpture raises the manifold environmental changes that differentiate but also re-knot the present-day Inuit and the Thule, changes that enrich an understanding of the reciprocal relationship between geological forces and cultural change. For example, the period of climate cooling led to a decline in bowhead whale hunting, the dispersal of large Thule settlements into smaller semi-nomadic



groups, an increase in seal hunting and sealskin trade, the rise of European whaling settlements that traded metal which the Inuit used for designing new tools, and the proliferation of sculpting in government-enforced resettlements. All of these developments are definitive of today's Inuit culture. But they require a converse reflection to account for how the Inuit seized solar effects to take hold of Thule history and make claims to the land in and through the aesthetic usefulness of their remains. Solarity thus poses the question of how to interpret material histories with a new acuity, coextensively with the transformative power of the elements. It is from this perspective that one can read the solarized whalebone archway in Barrow for its positioning of the Inuit in the colliding meanings of Thule whaling culture, the Little Ice Age, a traumatic modern resettlement, and an emergent future of land reclamation in the midst of global climate warming.

Solarity must not be misunderstood as the condition for a new level objectivity. It is not an evenly distributed illumination of land from above. Nor is it an invariant condition that can yield the linear development of a cultural ecology. Rather, as the sun shines its light down, warms the land and consumes its fleshy remains, it also nourishes new material relations. Solarity could therefore be understood as an elemental vector with the potential to multiply the meanings of archaeological remains. As much as the sun is endemic to techniques and interpretations of climate history and environmental archaeology, then, we must nevertheless seek from it the heterogeneous conditions from which fractured material histories come to light. By reading solarity alongside the shadows it casts, it becomes possible to enlighten the multiplication of meanings unfolding within the geology of the High Arctic.

### **Tupilaq, under the Moonlight**

If sun-weathered whalebone artefacts provided an opportunity for contemporary Inuit to actualize a Thule renaissance, then we might wonder what kind of history can be probed from the



*Fig. 2.* Tupilaq figures. Greenland National Museum and Archives. Photograph by the author.

nocturnal opposites to whalebone sculpture: the tupilaq figures of Greenland. Tupilaq originated in Thule oral tradition. The cultures of Iñupiat Nunaat (of Alaska), Inuit Nunangat (of Canada), and Kalaallit Nunaat (of Greenland) developed different versions of the figure, some preserving it as a ghost story, others as a mythic entity. When Danish and European traders arrived in Greenland in the late nineteenth century, they were transfixed by the mythology of the tupilaq and recorded animated stories about them. Greenlanders began to carve tupilaq figures to elaborate the ritual and its oral narration, and these soon became popular objects for trade (fig. 2).

In their shamanic origins, tupilaqs are spirits conjured through objects made of animal sinew, hair, teeth, skin, and bone, ideally combined with the bones or skull of a human child. The tupilaq is summoned to seek out and wreak havoc on

the enemy of its maker. The makeshift object would come to life through a ritual undertaken at night, galvanized by the light of the moon. The manufacturer would don an anorak backwards (with hood over the face), and chant over the tupilaq. Awakened in this way, the tupilaq would then glean magical power and be nourished by sucking on the maker's genitals. Finally, the maker would fling the tupilaq into the ocean to hunt the enemy. A tupilaq might be raised in vengeance but not without a risky condition: if the maker's enemy was more powerful, they might turn the tupilaq on its maker and the ritual would backfire, and the tupilaq would return to hunt the one who had cast the spell. It was therefore more than a magical conjuring because it netted magical force to an existing rivalry between two people. In this way, the social fabric of the Inuit accounted for the dangers of recoil in any covert exertion of power.

While the Christian sensibilities of European traders fed into a hysterical framing of Inuit cosmology as a barbaric "death cult," they were nevertheless compelled to collect tupilaq.<sup>15</sup> The eighteenth and nineteenth centuries saw stylistic flourishes in their manufacture. Soon they became objects to be traded and collected in their own right. Greenlanders began to fashion tupilaq from walrus and narwhal tusks, giving them flaring nostrils, gleaming wide eyes with dilated pupils, stretched lips, and polymorphous tongues. The ritualized assembly of human and animal parts was subsumed into a specialized carving practice. Today, tupilaq are, like whalebone sculpture, widely circulated commodities and a recognizable signifier of Greenlandic Inuit culture. But like the whalebone sculpture that recovers the Thule artifact, the tupilaq is an object that springs from a shadowy history of the circumpolar Inuit. Where the former object subsumes hundreds of years of sun exposure over which time it consumed and neutralized the material remains the Thule culture, the latter — charged by skin, sinew, and moonlit chanting — was prepared and refined for intercultural trade.

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15 Jens Peder Hart Hansen, Jørgen Meldgaard, and Jørgen Nordqvist, *The Greenland Mummies* (Copenhagen: The British Museum Press, 1985).

The concept of solarity is therefore set at a crossroads: it tempts the scientific discourse of environmental adaptability whereby primacy is afforded to climate-based phenomena and cultural change is taken to be a secondary effect. Yet this account of whalebone sculpture and tupilaq figures suggests that the Inuit took hold of the elemental charge of their artifacts as they cultivated new environmental relations. Solarity could either overshadow or elucidate the choices, innovations, and flourishes of the Thule and the Inuit undertaken over hundreds of years, as well as their coevolution with European settlers, often under the duress of colonialist deceit and trauma. Solarity is therefore not a determining environmental condition of cultural change, just as lunar energy is not a purely coincidental backdrop to the efficacy of the tupilaq. The complexity of Inuit history demands a rethinking through geocultural limitrophy rather than environmental determinism. With this in mind, we might question the extent to which solarity can overcome the dichotomous framework at the heart of the discourse of environmental adaptation, and whether tupilaq still seek out their enemies, but now vitalized by the rays of the sun.

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## The Kiln

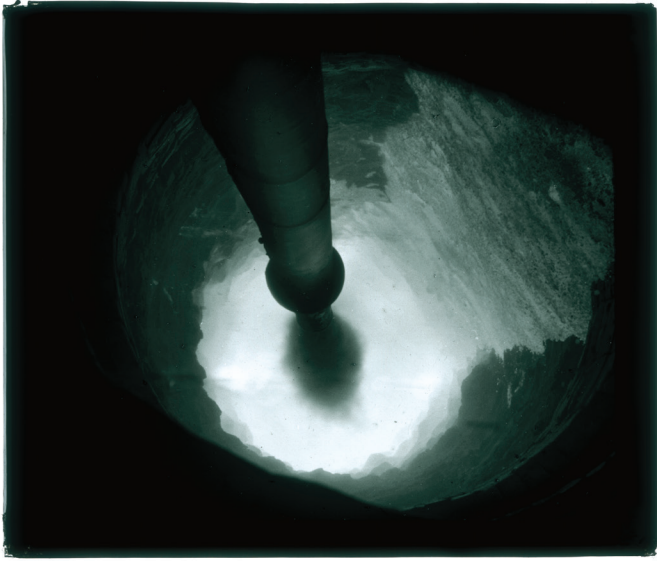
*Kim Förster*

Key to understanding the “large technological system” of a primary industry that the contemporary built world relies on, the cement kiln surprisingly has not yet received much critical attention despite its central role in cementing ideas, practices, and institutions of modernity throughout the twentieth century and despite a growing concern about its environmental, and social, damage.<sup>1</sup> Within the scope of revising architectural history, only recently has concrete — like steel, glass, and plastic a dominant building material today — become scrutinized for its carbon emissions, and others.<sup>2</sup> The kiln, inherently Promethean, must be seen as an actor in its own right, a technology that coun-

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1 Thomas P. Hughes, “The Evolution of Large Technological Systems,” in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, eds. Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Cambridge: MIT Press, 2012), 45–76.

2 Mark Jarzombek, an architectural historian who at the turn of the millennium still believed in the possibility of sustainability within the capitalist system, today questions the industrial global production of certain building materials, and thereby making the architectural profession responsible for its addiction — here, he refers to unquestioned universals (“quadrivium”) — to the industrial complex of steel, concrete, glass, and plastic. Mark Jarzombek, “The Quadrivium Industrial Complex,” *e-flux*



*Fig. 1.* Coal dust nozzle burning, in kiln, no date. In order to sinter the raw meal of limestone and marl at a temperature of  $1450^{\circ}\text{C}$ , a flame of significantly higher temperature is essential, and the combustion of fossil fuels in the rotary kiln is necessary. In the burning process of clinker, the limestone and marl mix is calcined, releasing carbon dioxide ( $\text{CO}_2$ ). Source: Research Library Pestalozzianum / Pestalozzianum Foundation, Zurich, GD\_83\_8-009.

teracts any kind of “solarity” as a fundamental social reorientation towards the sun and the political change that accompanies this. Elementary for much construction activity throughout the twentieth century, the kiln in the cement plant is a key site and subject of the Anthropocene that mixes industrial production, scientific knowledge, technological development, politics, and

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*architecture*, November 11, 2019, <https://www.e-flux.com/architecture/overgrowth/296508/the-quadrivium-industrial-complex/>.



design at different scales, all architectural, urban, and infrastructural, with financial interests.<sup>3</sup>

In elemental terms, the kiln, first of all, is an important technology in modern architecture, whose metabolism is shaped by the burning of fossil fuels and on these grounds enters into the environmental humanities. For the cement industry, it is pivot and axis for grinding and burning a raw meal of rock (mixed limestone and marl) that is rich in calcium carbonate ( $\text{CaCO}_3$ ), into clinker (an intermediary product).<sup>4</sup> This includes processes of drying, preheating, calcinating, and sintering (a thermal treatment to produce or change hardness and firmness) at a temperature of 1450° Celsius and above, which can only be reached with the help of air and fossil fuels.<sup>5</sup> Since the end of the nineteenth century, the industrial kiln has been the central device in the global cement industry both from the point of view of materialization and capitalization:<sup>6</sup> on the one hand, in mass producing Portland cement as hydraulic binder (next to water and aggregates — sand and gravel — the main raw material for pouring concrete) and, on the other hand, with cement plants spreading globally, it is an unprecedented and by all

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3 Adrian Forty, “Myths of the Origin of Modern Concrete,” *gta papers* 3 (2019): 69–77.

4 Adolf Koelsch, “Vom Kalkstein zum Zement: Dem Beton die Zukunft!,” *Cementbulletin* 1, no. 12 (1933): 2–5. Since 1933, the *Cementbulletin*, a publication of the industry representation Technische Forschung und Beratung, has published on topics of production and application of cement.

5 Fritz Keil, *Zement: Herstellung und Eigenschaften* (Berlin: Springer Verlag, 1971).

6 Portland cement as a main ingredient for modern concrete has passed through a layered history of inventions beginning at the end of the eighteenth century; reinforced concrete as a global building material, however, only became used a hundred years later with material, processual, and technological innovations. Given a material history of cement, that can be traced back to the Roman Empire, it is of no surprise that the OED lists earlier uses, both literal and metaphorical: cement (v.) — “To unite solid bodies with cement”; cementing (n.) — “The action of uniting with or as with cement”; or cementation (n.) in is alchemic use — “The action or process of cementing or producing cohesion.”

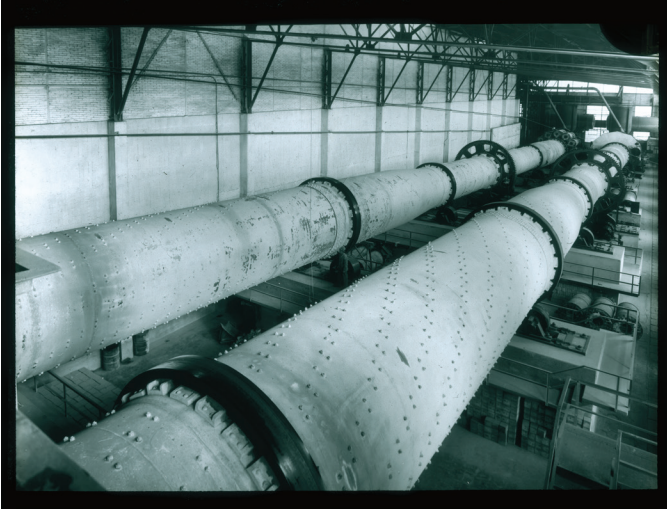


Fig. 2. Rotary kiln plant, no date. At the beginning of the 20th century, the Polysius AG Dessau, Germany became the market leader for rotary kilns and other machines used in the industrial production process of cement. Polysius equipped cement plants worldwide, including the one in Holderbank in Canton Aargau, Switzerland, from 1912 onwards the nucleus of today's global market leader Holcim. Source: Research Library Pestalozzianum / Pestalozzianum Foundation, Zurich, GD\_83\_8-007.

means modern building material.<sup>7</sup> Similar to the oil refinery, and along with the steel mill, the glassworks, or the chemical plant, the cement kiln orchestrated an industrial process at the center of an elemental metabolism of matter and material that facilitated the growth of global modernities.

And yet, more than just an instrument within the industrial production of cement, the kiln is also a modernist trope.

7 Adrian Forty, "Mud and Modernity," in *Concrete and Culture: A Material History* (London: Reaktion Books, 2012), 13–42, esp. 15. Forty, an architectural historian who recently discussed its different origin myths, has most outspokenly been interested in what makes concrete a "modern material!"

It was and still is associated with the fantasies, hopes, myths, and promises of industrial capitalism and its system of resource extraction, the cement industry being a continuation strategies to cheapen nature.<sup>8</sup> As Fordist production changed the patterns and dynamics of the global economic system both in terms of production and consumption at the onset of the second industrial revolution, the mechanized and soon fully electrified cement plant has fundamentally shaped how we build and live. Manufactured and sold as complete equipment called a “turn-key” factory, cement plants because since they objectify nature and externalize costs require new global histories of extraction, construction and architecture, and the kiln interferes with any future-oriented imaginary about energy and resource transition, corporate, state-led, or radical in the light of climate emergency. When taken as a point of departure, the kiln, in all its Anthropocene paradoxes, allows us to look beyond the deposited modernities of concrete (and those that vanished into thin air!).<sup>9</sup> As the heart, or hearth, of a building material, construction and real estate industry, it has meanwhile influenced the earth system in a variety of ways, accelerating the sedimentation and sealing of the pedosphere, emissions and the heating of the troposphere and thus contributes to the slow violence of the climate crisis, both directly and indirectly.

Modern narratives of architecture have presented those buildings, forms and structures made of reinforced concrete — considered man-made, “artificial stone” — as virtually indestructible, almost immaterial.<sup>10</sup> And yet, exposed to the

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8 Jason W. Moore and Ray Patel, *A History of the World in Seven Cheap Things: A Guide to Capitalism, Nature, and the Future of the Planet* (London: Verso, 2018), and Jason W. Moore, *Capitalism in the Web of Life: Ecology and the Accumulation of Capital* (London: Verso, 2015).

9 Jan Zalasiewicz, “The Anthropocene Square Meter,” in *Critical Zones: The Science and Politics of Landing on Earth*, eds. Bruno Latour and Peter Weibel (Cambridge: MIT Press, 2020), 36–43.

10 Sigfried Giedion, *Space, Time and Architecture: The Growth of a New Tradition* (Cambridge: Harvard University Press, 1941), and Peter Colins, *Concrete: The Vision of a New Architecture* (London: Faber and Faber, 1959).

elements such as the wind, rain, and sun and subject to chemical-technical processes, concrete also weathers and decays, acquiring a certain temporality, a lifespan of about fifty years.<sup>11</sup> Nevertheless, this has not detracted from its success. Its myth of durability, as possessing a kind of eternal time, in conjunction with the new economy of construction, based on obsolescence, helped distribute the cement as bulk commodity, replacing other building materials (e.g., timber, brick, and rammed earth) and, in the process, changing labor relations.<sup>12</sup> Even so, cement production has depended upon the availability of almost inexhaustible raw material deposits, the availability of entropy between sun and earth through coal, lignite, and oil, and recourse to unskilled labor. Those who worked with the kiln and the quarry performed some of the roughest, coarsest, dirtiest, and loudest jobs of all until dust and noise emissions were tackled. Especially in the Global South, where production is increasing due to the promise of modernization and development, workers continue to suffer because labor and environmental rights are violated there.

While the kiln, in all its activity, has fired the spread of industrialized prefabrication, mass housing, and infrastructure space, through the development of national and globalized markets, it has also relied upon and inherited a particular arrangement of the world that took shape in the twentieth century.<sup>13</sup> As a cen-

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11 J.W. Simpson and P.J. Horrobin, *The Weathering and Performance of Building Materials* (New York: John Wiley & Sons, 1970), and Fritz Keil, "Natürliche und technische Einflüsse auf Beton," in *Zement: Herstellung und Eigenschaften* (Berlin: Springer Verlag, 1971), 244–303.

12 For the modern paradigm of obsolescence, see Daniel Abramson, "Obsolescence and Its Future," in *The Routledge Companion to Critical Approaches to Contemporary Architecture*, eds. Swati Chattopadhyay and Jeremy White (London: Routledge, 2020), 231–43. For cement as bulk commodity, see Sarah Nichols, "Pollux's Spears," *Grey Room* 71 (2018): 141–55. For changed labor relations, see Michael Osman, "Managerial Aesthetics of Concrete," *Perspecta* 45 (2012): 67–76, and Sérgio Ferro, "Concrete as Weapon," trans. Alice Fiuza and Silke Kapp, *Harvard Design Magazine* 46 (Fall/Winter 2018): 8–33.

13 Sigfried Giedion, *Bauen in Frankreich: Bauen in Eisen, Bauen in Eisenbeton* (Leipzig: Klinkhardt & Biermann, 1928); Sigfried Giedion, *Building*

terpiece of the modern building material industry, the cement kiln, while at the beginning of a profitable yet unsustainable commodity chain, representing a move away from natural, solar building materials, surpassing them with an increasing capacity of constructive volume, has remained almost untouched, unchanged, and unchallenged.<sup>14</sup>

### Antinomy to Solarity

One of the tasks of an elemental solarity is to rethink, redefine, and readjust not only our relationship to modern energy sources, but also to industrially mass-produced building materials, especially reinforced concrete, insofar as we in the humanities today find ourselves within the contradictions of the Anthropocene. This is a dual challenge that is both historiographical and epistemological.<sup>15</sup> From this position, we can consider the cement kiln as a twin fire to the sun, but unlike the sun, it mirrors the intricate relationship of humankind and the nature of modernity. And yet, rather than the productive excess, the “accursed share,”

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*in France, Building in Iron, Building in Ferroconcrete*, trans. J. Duncan Berry (Santa Monica: The Getty Center for the History of Arts and the Humanities, 1995); and Giedion, *Space, Time and Architecture*. In contrast, the kiln is in the foreground in numerous company histories, which are often told as pioneering stories; see Jura-Cement-Fabriken, ed., *75 Jahre Jura-Cement-Fabriken: Aarau-Wildeggen 1882–1957* (Wildeggen, 1957), and Cementfabrik Holderbank, ed., *75 Jahre Cementfabrik Holderbank* (Rekingen, 1987).

- 14 Environmental scholar Vaclav Smil discussed energy and resources as the two economic, ecological, and social key issues and challenges of the twenty-first century. Herman Scheer, late social democrat, and father of the German *Energiewende* (energy transition), on the other hand next to solar energy also spoke of solar materials. Vaclav Smil, *Making the Modern World: Materials and Dematerialization* (London: John Wiley & Sons, 2013).
- 15 Eva Horn and Hannes Bergthaller, *The Anthropocene: Key Issues for the Humanities* (London: Routledge, 2020): 113ff. Literary scholars Horn and Bergthaller in a humanities perspective applied the geological metaphor of fault lines in order to work with, historicize, and think through the Anthropocene in various directions.

of the sun, the fire of the kiln is environmentally destructive, utilizing land to explore, mine, and quarry privatized deposits, and, ultimately, devastating social relations.<sup>16</sup>

Nevertheless, the bright light of cement production and concrete consumption has been repeatedly associated with progressive and utopian construction projects throughout the last century, for example through socialist and democratic mass housing or the Brutalist welfare state projects, such as education facilities, communal centers, cultural institutions, etc.<sup>17</sup> These modern, industrial processes centered around the kiln — of producing, transporting, and building with cement — have been massively capital- and energy-intensive and have consumed vast amounts of fossil fuels, through coal and oil-firing furnaces. Within modernity, concrete and cement were seen as universal, unavoidable, and unquestionable. The kiln was kept running, at least indirectly, by the habits, education, regulations, and discourses of a settled reality in which other possibilities did not exist, and, in the end, particular corporate interests prevailed.<sup>18</sup> Alternatives were, and still are for many unthinkable.

Despite the universality and anonymity of its product, the kiln, and its hedged solarly, is also sited and situated. A paradigmatic case study is the Aargauische Portland-Cement-Fabrik (Aargau Portland Cement Plant) in Holderbank, the canton of Aargau, Switzerland, which began at the foot of the Jura mountains along the river Aare where thick layers of limestone rock are exposed. This is the birthplace of the multinational Holcim Group, the self-proclaimed world leader in the production of cement and aggregates.<sup>19</sup> Founded in 1912, Holderbank was not the first modern cement plant in Switzerland. Various production sites had already been established in connection with the construction and expansion of the Swiss railroad network at

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16 Georges Bataille, *The Accursed Share*, vol. I: *Consumption*, trans. Robert Hurley (New York: Zone Books, 1991).

17 Forty, "The Geopolitics of Concrete," 101–44.

18 Nichols, "Pollux's Spears."

19 Peter Müller, "Holderbank," *Historisches Lexikon der Schweiz*, November 22, 2006, <https://hls-dhs-dss.ch/de/articles/041872/2006-11-22/>.

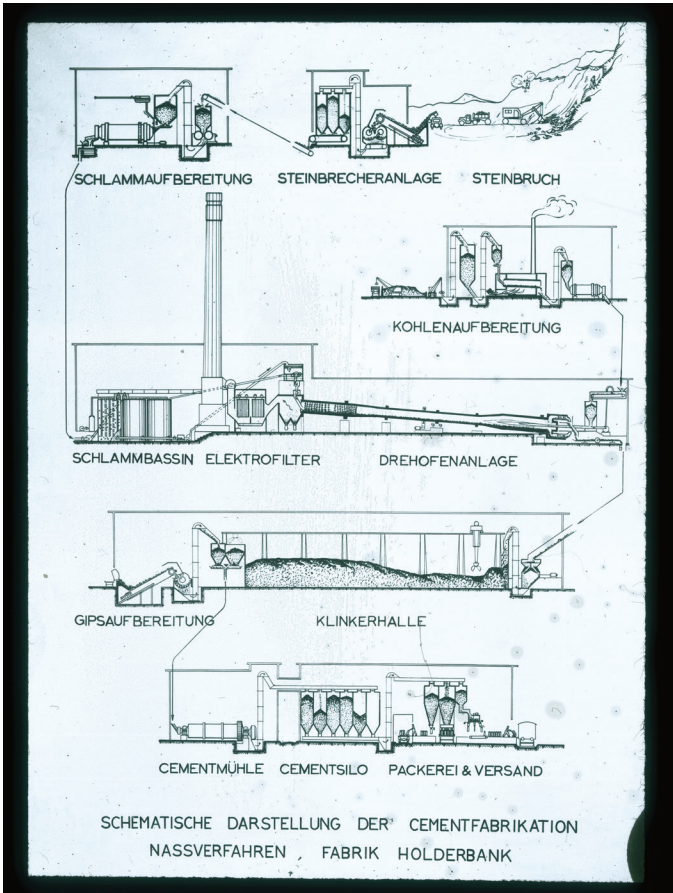


Fig. 3. Schematic illustration of cement manufacturing by the wet process at the Holderbank plant, no date. Shown are all the machines and processes organized around the kiln in the manufacture of Portland cement, exploiting rock strata and labor: from the quarry, via coarse crushers, a sludge treatment, a sludge basin, an electric filter, a rotary kiln hall, a coal mill, a clinker hall, a plaster mill, a cement mill, cement elevators, to a packing and shipping plant. Source: Research Library Pestalozzianum / Pestalozzianum Foundation, Zurich, GD\_83\_8-002.

the time.<sup>20</sup> While Holderbank had entered an already saturated national market, wherein the prices were fixed by a trust after WWI, despite the cyclical fluctuations in the interwar year, the company grew quickly, profiting from the new construction projects of the modern era, and the globalization of production.

What distinguished Holderbank as a new supplier and competitor was that their kiln, indeed the entire cement plant, was supplied by G. Polysius, a German iron foundry and machine works based in Dessau. After representing itself internationally at the World's Columbian Exhibition in Chicago in 1893, Polysius specialized in the sale of all kinds of machines for processing hard raw material, and especially in the innovation of grinders and rotary kilns.<sup>21</sup> While it is important not to overemphasize the technological history of patents, plants, and processes alone as the cause for Holderbank's success, in a sort of technological determinism, the double rotary kiln at the heart of Holderbank was nevertheless a technology that set it above others in terms of its productivity. This state-of-the-art machine produced high quality cement consistently, day and night, all year round — all of this was made possible by the orchestration of ropeways, belt conveyors, coarse crushers, a drying plant, a coal mill, a clinker hall, a cement mill, storage sheds, and packing plants.<sup>22</sup> Polysius also provided the power plant, steam boilers, generators, motors, iron construction, railway tracks, railway cars, in addition to the various kinds of expertise from engineers, chemists, assembly inspectors, supervisors, and fitters. The kiln thus was situated within a modern "megamachine" that to stay profitable had to continue rotating.<sup>23</sup>

This productive capacity would have been unconceivable, however, without the quarry, where limestone and marl were

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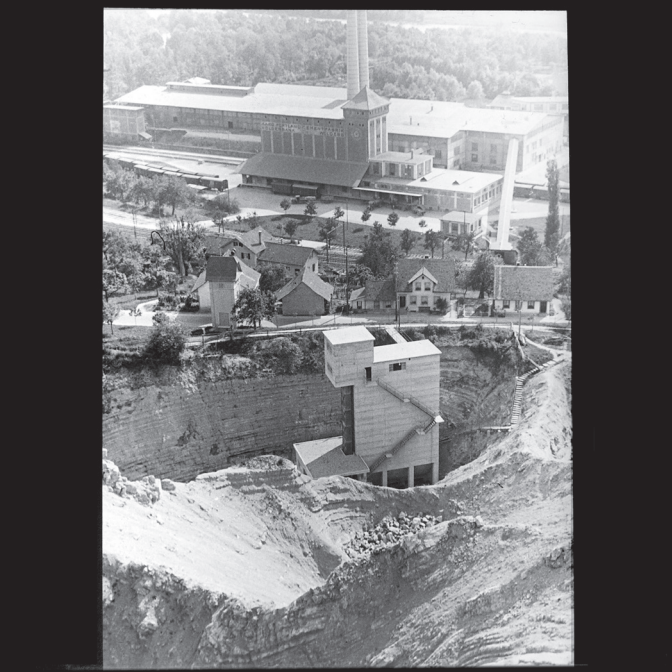
20 Andreas Steigmeier, "Adolf Louis Gygi," *Historisches Lexikon der Schweiz*, May 18, 2005, <https://hls-dhs-dss.ch/de/articles/029550/2005-05-18/>.

21 Renate Köhne-Lindenlaub, "Polysius," *Neue Deutsche Biographie*, 2001, [www.deutsche-biographie.de/pnd139799877.html](http://www.deutsche-biographie.de/pnd139799877.html).

22 G. Polysius AG, ed., *Aargauische Portlandzementfabrik Holderbank-Wildegg* (Dessau, 1912).

23 Lewis Mumford, "The First Megamachine," *Diogenes* 14, no. 55 (1966): 1–15.





*Fig. 2.* Holderbank cement works, pit, and crusher, 1936. Aerial and landscape photography showed early on the wounds of industrial exploiting the native rock strata, limestone and marl deposits of the Jura mountains in Northern Switzerland, and the architecture of the nearby cement works, the extended shed with the double rotary kiln in the background. Source: ETH-Library Zurich, Image Archive, Photographer: Leo Wehrli / Dia\_247-09799 / CC BY-SA 4.0.

extracted first by the “Rolloch”-method, a mix of surface and underground mining of driving tunnels in the lower part and excavating funnel-shaped pits down to the shaft to extract rock, and later by open-pit mining with large pipe-hole blasting. A political geology of the modern kiln and its underlying knowledge must necessarily address the granting of concessions for

the exploitation of natural resources.<sup>24</sup> At Holderbank, the stone put to work in the kiln was quarried from a 250-meter-thick limestone strata of the Oxfordian age—sedimented minerals of the upper Jurassic period, mixed with fossilized crustaceans that had thrived under the sun some 155 to 180 million years ago.<sup>25</sup> Tectonics and the erosion of the river, which cut its way further and further into the Jura mountains, facilitated mining. The emergence of aerial and landscape photography in the first decades of the twentieth century captured the extent that the kiln and the quarry had impacted the environment, inflicting wounds, and leaving scars in the landscape at that time.<sup>26</sup>

As elsewhere, at Holderbank the assemblage of kiln and quarry was wide-ranging: always *driven* by a powerful combination of entrepreneurial spirit and profit-making interests; *enabled* by railway tracks and the supply of adequate fuel, without interruption, to generate the heat needed; *powered*, at first by hydroelectricity utilizing the river flow for energy production; *supported* by the advancement of modern sciences, chemical knowledge<sup>27</sup> on calcination and geological knowledge<sup>28</sup> on

24 Adam Bobbette and Amy Donovan, “Political Geology: An Introduction,” in *Political Geology: Active Stratigraphies and the Making of Life*, eds. Adam Bobbette and Amy Donovan (London: Palgrave Macmillan, 2019), 1–34.

25 It was Alexander von Humboldt who in 1795 had introduced the term “Jura stone” for a lime stone, which was applied to rock strata in scientific literature.

26 The aerial photography taken by Walter Mittelholzer from 1919 to 1937 and the landscape photographs taken by Leo Wehrli in 1936 are archived in the Image Archive Online of the ETH Library, Zurich; see [http://www.e-pics.ethz.ch/en/home\\_en/](http://www.e-pics.ethz.ch/en/home_en/); esp. <http://doi.org/10.3932/ethz-a-000492273>, and <http://doi.org/10.3932/ethz-a-000082059>.

27 Chemical knowledge was produced in laboratories, e.g. by Empa, the Swiss Federal Laboratories for Material Testing, which in the 1920s prove the quality of cement for Holderbank; see Mirko Roš, *Die Portlandzemente der Aargauischen Portlandzementfabrik Holderbank-Wildeggen (Schweiz)* (Lenzburg: Cement Holderbank, 1929), and Bruno Meyer, “Ludwig von Tetmajer Przerwa,” *Historisches Lexikon der Schweiz*, October 29, 2013, <https://hls-dhs-dss.ch/de/export/articles/031686/2013-10-29/>.

28 Geological knowledge was disseminated through publications and visualizations, e.g., by leading Swiss geologist Albert Heim, who in 1919–1922 published a new two-piece volume of his *Geology of Switzerland*; see

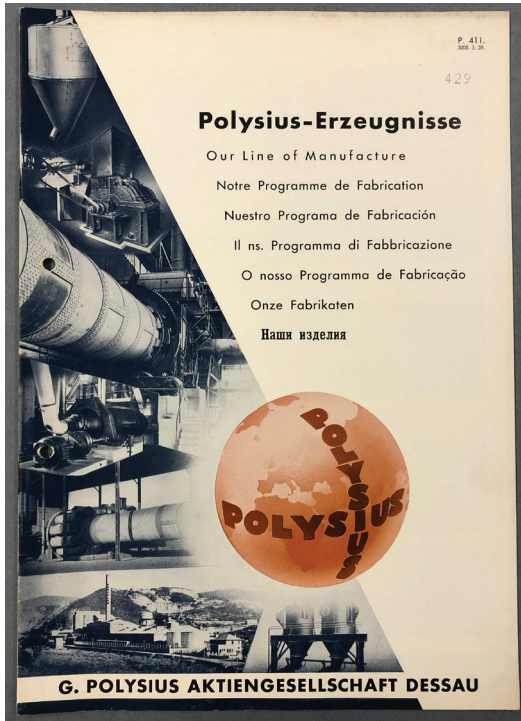


Fig. 5. Polysius's products — “Our line of manufacture”, no date. A multilanguage brochure of the Polysius AG Dessau offered its machines, entire “turnkey” cement plants (including belt conveyors, coarse crushers, drying plants, coal mills, cement mills, and rotary kilns), around the globe through a system of agents, dominating the market in the interwar period. Source: Saxony-Anhalt State Archives, Germany I 414 Polysius AG Dessau, No. 436/3 fol. 429.

stratigraphy at the service of resource extraction; capitalized upon by the distribution to nearby markets readily accessible by rail and trucks; and eventually *manifested* through the works of

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Albert Heim, *Geologie der Schweiz* (Leipzig: Christian Bernhard Tauchnitz, 1919–1922), and Sibylle Franks, “Albert Heim,” *Historisches Lexikon der Schweiz*, May 29, 2008, <https://hls-dhs-dss.ch/de/articles/028851/2008-05-29/>.

architects and engineers eager to experiment.<sup>29</sup> An environmental history of construction and extraction that addresses all of the fulfilled as well as unfulfilled hopes, of both the winners and the losers—past, present, and future—according to a methodological symmetry complicates architectural histories and draws from new materialisms, vitalist or historical, to articulate and counteract the impact upon and exploitation of people and planet, at high energy intensity, which must be at the center of any radical solarly for a planetary livability.<sup>30</sup>

### The Global Kiln Paradox

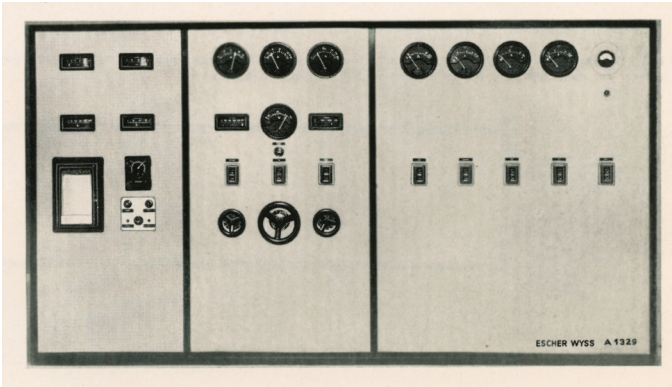
Over the course of the twentieth century, the kiln as key technology gained global relevance, with the industry's claims to ubiquity.<sup>31</sup> Polysius, already market leaders by WWI not just in Europe but also globally, had distributed their kilns and entire cement factories around the world, fueling the globalization of

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29 Cement as a mass product entered the market through architecture and infrastructure, e.g., the industrial facilities, bridge constructions, also sanatorium buildings and resting halls, of Swiss civil engineer and entrepreneur Robert Maillart, which were featured in Sigfried Giedion's classic *Space, Time and Architecture*, at first delivered as a lecture series at Harvard University in 1938.

30 Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham: Duke University Press, 2010), and Anna Lowenhaupt Tsing, "When the Things We Study Respond to Each Other: Tools for Unpacking 'the Material,'" in *Anthropos and the Material*, eds. Penny Harvey, Christian Krohn-Hansen, and Knut G. Nustad (Durham: Duke University Press, 2019), 221–44. A material history of concrete and cement, as anthropologists have pointed out, will speak of complex biographies, stories of extraction, production, promotion, distribution, and construction, if not demolition; see Penny Harvey, "Materials," *Cultural Anthropology*, September 24, 2015, <https://culanth.org/fieldsights/materials>, and Eli Elinoff, "Cement," *Cultural Anthropology*, June 27, 2019, <https://culanth.org/fieldsights/cement>.

31 From an anthropological perspective, Kali Rubaii is interested in the local specificities of globally active corporate enterprises; see Kali Rubaii, "Environment in Context: Cement, War and Toxicity: The Materialities of Displacement in Iraq," interview by Huma Gupta and Gabi Kirk, *Jadaliyya*, June 8, 2020, <http://www.jadaliyya.com/Details/41244>.



*Fig. 6.* Escher Wyss Switchboard, Roche cement plant, no date. As a result of the Second World War, the mechanical engineering company Escher Wyss & Cie. of Zurich, specializing in turbines, centrifuges, and boilers, started to also produce kilns and grinding machines. The new Roche cement plant, which opened in Valais in 1947 as part of the Holderbank company, also featured a new type of control panel, including operating devices and instruments, such as a kiln monitoring system. This measured the carbon dioxide and carbon monoxide content of the combustion gases at the end of the kiln, thus providing effective knowledge of the emissions. Source: City Archives, Zurich, Switzerland, VII.419, Company Archive Escher Wyss AG.

cement and concrete as a modern building material.<sup>32</sup> Holderbank too had extended its activities internationally in the interwar period, first with subsidiaries in Europe (the Netherlands, Belgium, France, and Germany) and then in Egypt, Lebanon and South Africa. Parallel to this, as the building material industry globalized, Holderbank introduced a new form of organization, separating cement production from financial holding, which was investing in kilns worldwide, as had already been

<sup>32</sup> At the beginning of the twentieth century, Polysius began to sell complete cement plants, and not only marketed them throughout Europe and North America, but also shipped them to Egypt in 1907 and China in 1908. A year before reorganizing as a stock corporation in 1928, G. Polysius AG had entered the promising American market opening a foreign branch in Bethlehem, Pennsylvania.

the case in the oil, mining and transport industries. In 1930, the “Holderbank Financière” was founded, presided over by Ernst Schmidheiny, and eventually became the nucleus of a billion-francs corporation.<sup>33</sup> Since then, Holderbank has capitalized on the scalability of cement production in and through the kiln in the postwar years, producing in North and Latin America under the name of “progress,” “innovation” and “growth,” with low profit margins.

Besides the extractive practice of “Abbau,” or unbuilding, the constructive practice of “Bauen,” or building, encompassing both the creation of structures and infrastructures exerted an equally significant impact on the geosphere.<sup>34</sup> After WWII, new construction in Switzerland not only materialized in single family homes and large-scale housing estates of the 1960s, as documented in the Swiss architectural magazines of that very decade.<sup>35</sup> It also took on the special form of “Terrassenhäuser,” literally “terraced houses,” i.e., horizontally staggered residential housing typologies made from concrete, which became popular in the 1960s for home ownership, and were erected, not far from the kilns, on the southern flanks of the Jura mountains and the Alpine foothills. On these flanks, they were oriented toward the sun, less for solar gain though than for big sunroofs

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33 Architectural historian Sarah Nichols has pointed to the historical connections of the Swiss cement industry importing the trust model from American capitalism, while focusing on the national level, and the state as an economic actor, and not at the international scale, see Nichols, “Pollux’s Spears,” 142ff. This was the kick-off of the Schmidheiny-dynasty, encompassing the asbestos cement industry of Eternit as well as leading machine works; see Ernst Schmidheiny, “50 Jahre Cementfabrik Holderbank-Wildegg AG,” *Schweizerische Bauzeitung* 80, no. 40 (October 4, 1962): 685–88, and Hans O. Staub, *From Schmidheiny to Schmidheiny: Swiss Pioneers of Economics and Technology*, vol. 4 (Meilan: Association for Historical Research in Economics, 1994).

34 Lewis Mumford, “Paleotechnic Paradise: Coketown,” in *The City in History: Its Origins, Its Transformations, and Its Prospects* (New York: Harcourt, Brace & World 1961), 446–81.

35 Prominent Swiss architectural magazines were *Werk: Schweizer Monatschrift für Architektur, Kunst und künstlerisches Gewerbe* and *Bauen und Wohnen*, which later merged.

and big views.<sup>36</sup> From an Anthropocene perspective, these Terrassenhäuser could, therefore, be viewed as an anthropogenic form of orogenesis, applying a concrete coating to the upper rock strata. As a fundamental technology at the center of geographies of extraction and construction — histories of de-stratification and re-stratification in an appropriation of geological terminology<sup>37</sup> — in the second half of the twentieth century kilns in the Global North had provided cement for a certain “imperial” mode of living, while in the Global South self-building prevailed.<sup>38</sup>

With the construction boom and the push toward urbanization in Switzerland during the post-war decades, the kiln’s capacities for growth within the domestic market also expanded. This phase of acceleration, increased resource (especially oil) consumption, termed by Swiss climate historian Christian Pfister the “1950s Syndrome,” culminated with new forms of energy production, the construction of water dams in the Alps as well as of nuclear power plants especially in the canton of Aargau, all of which were poured in concrete.<sup>39</sup> By 1958, a turning point in material history, Holderbank had also been publicly traded on the stock exchange. Therefore, crucial to the impact of Holderbank’s kilns worldwide as the main mechanism of an international corporation, integrated into regional supply chains and global value chains, in economic, ecological, and social terms, was the interplay between consolidation at home, eventually controlling the domestic market, and a global corporate strat-

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36 Lucius Burckhardt and Urs Beutler, eds., *Terrassenhäuser*, Werk-Buch, no. 3 (Winterthur: Werk, 1968). On “Terrassenhäuser,” see also two special issues by *Werk*, October 1964 and June 1966.

37 Manuel De Landa, *A Thousand Years of Nonlinear History* (New York: Swerve Editions, 2000).

38 Markus Wissen and Ulrich Brand, “Imperial Mode of Living,” *Krisis: Journal for Contemporary Philosophy* 2 (2018), <https://krisis.eu/imperial-mode-of-living/>.

39 Christian Pfister, “The ‘1950s Syndrome’ and the Transition from a Slow-going to a Rapid Loss of Global Sustainability,” in *Turning Points in Environmental History*, ed. Frank Uekötter (Pittsburgh: University of Pittsburgh Press, 2010), 90–117.

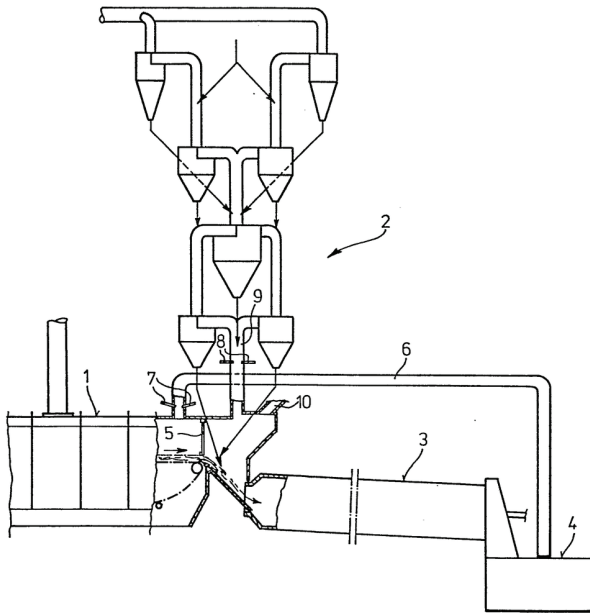


Fig. 7 Krupp Polysius AG: European Patent Application EP 0041093A1, 1981. Method and plant for burning cement, wherein the preheating and precalcination of granulated raw material takes place on a travelling grate preheater using cooler air, while exhaust gases from the rotary kiln are fed to a cyclone preheater for preheating floury raw material. Later, alternative fuels are added in a cyclone preheater. Source: Patent Bulletin 981/49, December 9, 1981. <https://data.epo.org/publication-server/document?iDocId=40043&iFormat=2>.

egy that involved expansion into the Asia Pacific region in the 1970s, and further advances into Eastern Europe, the Middle East, China, India, and Southeast Asia in parallel with the new geopolitical situation that emerged in the 1990s in the neoliberal age.<sup>40</sup>

<sup>40</sup> The history of corporate environmental communication encompasses, that in parallel the energy and ecology crisis of the 1970s, the Holder-



In recent decades, with production having quadrupled, the international cement market has reorganized itself around a global web of kilns through large corporations. The Swiss multinational cement producer Holcim, which since 2001 is operating under the new name, to act even more strongly as a global corporation, has been competing with multinational companies like Heidelberg Materials from Germany, Cemex from Mexico, or Dangote from Nigeria, not to mention the large-scale state-owned Chinese enterprises. In fact, the cement industry has since been making use of other paradigms to stimulate their business. In order to optimize production costs and secure competitive advantages, company history prides itself with that kilns in Switzerland (and internationally) are for some time now fueled also by so-called “alternative fuels”, as conventional fossil fuels, whatever is cheapest, are replaced under the banner of sustainability by what is considered waste—and would otherwise end up in landfills or incineration plants.<sup>41</sup> However, environmental justice literature sees running co-incineration plants in so-called “sacrifice zones” as highly emissive, “producing wasted people and wasted places,” while not reducing waste at all. We must be aware that “alternative fuels” here refers to a strange mix of the dirt of civilization: animal fat and meal, waste oils, scrap materials, sewage sludge, plastic refuse, solvents, and especially used car tires, etc. making hazardous waste recycling big business.<sup>42</sup> Despite a substitution grade of 40 percent (and

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bank group in Switzerland, operated for a short time a cement plant in Rekingen, Aargau, then considered the “most modern” in Europe, while after closing down its oldest production site in Holderbank and demolishing the kiln there in the 1980s, reused the old sheds for art exhibitions, and recultivated the former quarry, turning it into a conservation area, a place of learning and contemplation.

- 41 For the use of alternative fuels, see Georges Spicher, Hugo Marfurt, and Nicolas Stoll, eds., *Ohne Beton geht nichts: Geschichte der schweizerischen Zementindustrie*, NZZ Libro (Zurich: Editions Neue Zürcher Zeitung, 2013), 270–73.
- 42 Marco Armiero, *Wasteocene: Stories from the Global Dump* (Cambridge: Cambridge University Press, 2020), 10. For a discussion of the “sacrifice zone,” see also Jason W. Moore, “Wasting Away How Capitalism Lays

various forms of air, soil and water pollution linked), these fuels merely mas the real issue of the kiln, which is its continued emission of high levels of carbon dioxide.

Today, from a climatological and civilizational point of view, kilns are once again making history, but now with regard to their impact on the composition of the atmosphere. Moreover, Holcim, which since its merger with the French competitor Lafarge in 2015 is world leading by volume and thus responsible, not only in Switzerland but internationally, has been repeatedly criticized for their “toxic factories.” Even at the Swiss locations, kilns still produce pollutants (e.g., benzene, which is carcinogenic, as well as ammonium gas, carbon monoxide, sulfur dioxides, nitrogen oxide, and particular matter, etc.), as regulated by the Swiss Clean Air Acts, and despite state-of-the-art filter and sensor technology. Internationally, kilns admittedly are subject to different standards and levels of inequality, for example in India, which was debated with regard to both particulate matter and elemental emission in addition to exploitative employment contracts before Holcim decided to better sell its businesses there (as well as in Brazil) in 2022 to rather concentrate on refined products for the North American markets while cement production and atmospheric pollution is ongoing.<sup>43</sup> Can we therefore say from an elemental perspective that, as a “vibrant matter,” the kiln kills?<sup>44</sup>

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Waste to the Web of Life, and Why It Can't Stop,” Working Paper, World-Ecology Research Collective, 2022, <https://jasonwmoore.com/wp-content/uploads/2022/10/Moore-Wasting-Away-WERC-Working-Paper-October-2022.pdf>. For a critique of waste incineration in co-processing plants of the Mexican cement industry by the Global Alliance for Incineration Alternatives (GAIA), see Magdalena Donoso, “In Mexico: Time to End ‘Sacrifice Zones,’” *Zero Waste Europe*, December 22, 2017, <https://zerowasteurope.eu/2017/12/in-mexico-time-to-end-sacrifice-zones/>.

43 R.K. Gupta, Deepanjan Majumdar, J.V. Trivedi, and A.D. Bhanarkar.

“Particulate Matter and Elemental Emissions from a Cement Kiln,” *Fuel Processing Technology* 104 (2012): 343–51.

44 Timothy Morton, “Elementality,” in *Elemental Ecocriticism: Thinking with Earth, Air, Water, and Fire*, eds. Jeffrey Jerome Cohen and Lowell Duckert (Minneapolis: University of Minnesota Press, 2015), 271–85. To apply a question raised by Morton, namely what is elemental about each element.

This question, extrapolated on a planetary scale, concerns the ongoing agency of the kilns of the world, which alone contribute an astonishingly 8 percent of global carbon dioxide emissions. This is all the more startling when there is more cement produced, more concrete poured worldwide than ever before, and construction continues to rise at a growth rate of 5 percent annually.<sup>45</sup> It is particularly damaging that the interplay at the global scale between the growth-based exploitation of resources, modernization, and social change on the one hand and global heating, extreme weather events, and sea level rise on the other is known not just to experts but also to what is repressed in the collective mind. And particularly serious is that most environmental impact will happen over time and elsewhere.

The kiln counteracts any kind of solarly: socio-cultural ideas, values, and symbols fundamentally different from those of “petro-modernism” or what might be called “cement-modernism” that would demand a closure of all cement plants and a shift toward solar energy and solar materials (i.e. a biobased, circular, non-extractive, regenerative way of building and living in tandem with strategies of recultivation at all scales). In other words, when the principles and possibilities of an elemental solarly are addressed and advocate for transition, they must also always include arguments for dismantling and replacing the building industry and the building culture of modernity.

### Is There a Solar Solution to the Kiln Problem?

One would think that there could be a solar solution to the kiln problem. Yet, as we know, innovation is not salvation. Even though the industry, often said to be inert, is active in several arenas primarily through the promotion of sustainable technologies, it also knows how to make itself “indispens-

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<sup>45</sup> David Harvey, *Abstract from the Concrete* (Berlin: Sternberg Press, 2016). Following Vaclav Smil, David Harvey was one of the first in critical discourse to point to the high increase of cement production for China’s rapid urbanization.

sable” without actually addressing the real problem. It pushes it downstream — a technological fix to a much larger problem. This is evident in experimentation with solar-powered furnaces, which, nevertheless, produce a synthetic gas out of high-carbon waste without cutting carbon dioxide emissions. It is also evident in Holcim’s implementation of the fourth industrial revolution, “industry 4.0,” in cement production in Switzerland since it is capital intensive, which saw an increase in the industrial automation of the kiln based on a complex networking and communication of machines, devices, sensors, humans, in addition to an upgrade through AI, once again a promise of greater efficiency.<sup>46</sup>

The sustainability paradigm’s solution to the kiln problem can also be seen in the construction industry’s introduction of recycled concrete products onto the market, which are energy-intensive to produce and still require cement as a binder; or its experimentation with alternatives binder, for example, the admixture of additives, fly ash from hard-coal-fired power stations or slag sand from steel production, both industrial residues, or other substitute materials, which can partially minimize or even eliminate the cement content but do not solve the energy issue of industrial production and that of waste as such; or, possibly too, digitization through the automation of construction, design, and formwork and through the use of robots, which promise optimization, precision, and economy in material terms, while also introducing completely new human-machine relationships in extraction and construction.<sup>47</sup>

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46 The use of solar energy for cement production has been tested at the Paul Scherer Institute in Villingen, canton of Aargau; see “Die Sonne geht auch für Zement auf,” *Paul Scherer Institute*, January 14, 2013, [www.psi.ch/de/media/forschung/die-sonne-geht-auch-fuer-zement-auf](http://www.psi.ch/de/media/forschung/die-sonne-geht-auch-fuer-zement-auf), and “Solar Energy in Cement Manufacturing,” *Holcim*, June 26, 2015, <https://www.holcim.com/solar-energy-cement-manufacturing>.

47 At the NEST building in Zurich, a pilot and demonstration project, part check-in desk, research laboratory, guest house, as well as offices, conference room, and event space of Empa on behalf of the ETH domain, which aims at imagining the future of construction, mixing the interests of architects, academia, state and industry, concrete had been the “go-to”

However, can we put the sole blame on the kiln itself? Embedded as it is in complex networks of building culture, corporate interests, and federal agencies, which issue comparatively lax environmental requirements, foster international competition, and allow corporate lobbying in the public sphere. The sad material fact is that we would still need concrete and cement for retrofitting existing infrastructure, not to mention building new ones. And even if conventional cement production volume is reduced and regulated, we must not forget a fundamental contradiction that the chemical process of calcination in the kiln, the so-called thermal decomposition reaction that turns limestone and marl into calcium oxide (CaO) and releases carbon dioxide (CO<sub>2</sub>) will still be responsible for half of the climate-damaging emissions.<sup>48</sup>

As a technology that has been and still is upgraded for efficiency and profitability, yet still seems deemed to be un-retrofitable, or at least in conflict with large-scale energy transition, the kiln thus poses a twofold problem that eludes the nationalization and the global governance of resource production:<sup>49</sup> it is not only that no satisfactory solar substitute for fossil fuels in cement production can be found, but that carbon dioxide escapes from processing rock strata itself in the transformation of matter into material, of limestone and marl into cement. And even if the Swiss industry and other countries of cement production in the Global North can afford new technologies for carbon capture and storage (CCS), which are considered necessary, especially to achieve carbon neutrality by 2050, but expen-

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material for the shell, as opposed to a timber construction; <https://www.empa.ch/web/nest/overview>. Swiss architecture firm Gramazio Kohler, who designed the building, with their dfab house, a unit presented on the upper floor, test and showcase their recent experiments in digital fabrication; <https://dfabhouse.ch>

48 Forty, "Natural and Unnatural," in *Concrete and Culture*, 69.

49 Cymene Howe, et al., "Paradoxical Infrastructures: Ruins, Retrofit, and Risk," *Science, Technology, & Human Values* 41, no. 3 (May 2016): 547–65. The kiln, because of its generative and degenerative characteristics, thus might be seen as a paradoxical infrastructure.

sive and electricity-consuming in themselves, a gap remains in their practices in the Global South.

Due to this default or impossibility, the kiln carries an infinitely tragic futurity, and its planetary consequences one cannot conceive: the combustion of thousands of tiny suns, given the number and rising production volume of cement plants worldwide (in 2018, Holcim alone owned 270 cement plants), while a large share of the coal burned in cement plants globally is actually traded in Switzerland. However, for a solarity to unfold next to the consideration of social and economic dimensions, a new cultural and political valence of cement is needed; and considering this dark side of the sun, going beyond its all-encompassing democratic spirit, to contribute to decarbonizing, and decolonializing, future imaginaries, new forms of international governance and justice are also needed: responsibilities need be shared across states and corporations; there must be climate restoration and cultivation of all the systems of Earth; and there must be continued reparation for long-term impacts so that all the costs, once externalized in the name of progress and economic, ecological, and social growth, can be covered, even if this is already anticipated and adopted by industry.<sup>50</sup>

The questions remain whether a “global society” can limit and control the kiln and if so how might we collectively manage it in a more effective and sustainable way. For many it is still difficult to reimagine what it means to recycle, to reuse, or to even reduce both building materials, elements, and entire buildings, if building, then with circular or compostable materials and otherwise design for deconstruction and disassembly.<sup>51</sup>

50 Holly Jean Buck, *After Geoengineering: Climate Tragedy, Repair, and Restoration* (London: Verso, 2019), 24ff.

51 Hermann Scheer, *The Solar Economy: Renewable Energy for a Sustainable Global Future* (London: Earthscan, 2002). Another research unit at the NEST is UMAR (Urban Mining and Recycling) by German architects Werner Sobek, Dirk Hebel, and Felix Heisel, which pilots and demonstrates recycled materials and which also serves as a case to calculate the environmental impact of concrete vs. timber structures; see Efstathios Kakkos et al., “Towards Urban Mining — Estimating the Potential Environmental Benefits by Applying an Alternative Construction Practice: A Case Study

This also means to stop demolition — while achieving longer life spans by practices of repair, care and maintenance — and, more extremely, to stop new construction. Despite statements to the contrary from all kinds of stakeholders, while align with the sun we have to learn to question the kiln — and the assemblages that it activates and mixes together — and revise modern industrial processes which underlie our dependency, not only on fossil fuels but on concrete and cement.

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from Switzerland,” *Sustainability* 12 (2020): 5041. A more recent research unit is Sprint, realized in 2021, by Baubüro in situ, a Basel-based office, that made a name for a rather reuse-oriented practice of elements; <https://www.insitu.ch/projekte/320-unit-sprint-im-nest-empa>

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## Twilight

*Dominic Boyer*

Curtain opens to reveal a small clearing surrounded by rocks somewhere in the wilderness. Three figures are huddled around a fire.

ONE gets up and squints at the horizon.

ONE

Can you tell yet?

TWO stands impassively, arms crossed, shaking their head.

ONE (cont'd)

How about you?

THREE steps quickly forward to the edge of the clearing, gazing into the distance and opens their mouth before closing it again. Stands on their tiptoes.

THREE

Ok, yes, I think I can definitely make out that... Well, actually, no.

ONE

(a bit tense)

It has to be one way or the other, doesn't it? How much longer are we supposed to wait?

ONE turns accusingly toward TWO.

ONE (cont'd)

Would it kill you to say something, anything? Your silence is stressing everyone out.

TWO rolls their eyes, turns away. ONE throws their hands up and stalks to the other side of clearing. THREE tries to calm the situation down.

THREE

What we know is that we're the children of light or the children of darkness. We're on the verge of something. In other words, we're dawning or dusking right now.

ONE and TWO are unmoved, backs still facing each other.

THREE (cont'd)

And, my feeling, and it's no secret, is that we are dawning.

ONE

(over their shoulder)

And what's your evidence for that  
conclusion might I ask?

THREE

Well the birds are singing for one  
thing.

ONE

I don't hear any birds.

THREE

If you weren't talking so loudly you  
could hear them.

They listen for a moment.

ONE

That's a bat if it's anything.

THREE

Well then, look at how the sky is  
brightening. You know how the sky  
swells with light just before dawn. The  
blackness shimmers and turns silver  
gray. And that's just the beginning of  
the whole crepuscular spectacular.  
First purples and indigos wash across  
the horizon...

ONE

(shaking their head)

Stories and dreams.

THREE

(growing increasingly enraptured)

And then the first flickers of salmon and dusky orange play across the horizon, the opening credits of a new day. It's not long now until the sweet plantain light comes and finally daybreak! The sun itself, slicing the belly of the sky, lustrous rays searing the heavens!

ONE

None of that is there! Please stop with this lunatic fantasy.

THREE slumps.

THREE

I wish it were memory.

ONE

We can't see anything because of these rocks. And the smoke from the fire. At least I can do something about that.

ONE spins and walks purposefully to the fire, trying to dramatically stomp it out but they keep getting singed and retreat. Their efforts get more dramatic and slapstick and it isn't long before they are rolling on the ground trying to extinguish the fire while avoiding being burned. TWO turns around and walks swiftly over to ONE pulling them away from the fire.

TWO

All you're doing is spreading the fire and smoke around. Now we really can't see what's going on.



ONE, singed and disheveled, sits up and pants.

ONE

Oh, now you can talk. So what's your big idea?

TWO ambles away.

TWO

We wait.

ONE

How brilliant. How decisive. We've been doing nothing but waiting and watching for I don't know how long.

THREE lets out an existential sigh.

THREE

I'm so depressed.

TWO

We wait to see if it's real this time. There have been so many false dawns and fake dusks. I'm not getting worked up about another one.

ONE

Because your sensitive soul can't handle another disappointment. I get it. But you appall me.

TWO shrugs and ambles away to the edge of the clearing, back to the horizon.

ONE (cont'd)

Control freak! Coward!

SOLARITIES

THREE rolls over on to their belly and let's out another loud sigh.

THREE

We're doomed.

ONE

Don't let that idiot over there get you down. We're going to try something else. We have to keep trying, right?

THREE sits up quickly.

THREE

I'm in!

ONE begins stalking around the clearing. THREE begins following them, imitating them unconsciously.

ONE

Okay we really can't tell what's happening because of the smoke, right?

THREE

And the rocks.

ONE

Right, also the rocks. And we know that we're either facing dawn or dusk. One or the other, for sure.

THREE

And the world is always turning toward the morning. I heard a bird.

ONE gives THREE a skeptical glance.

ONE

What we need ... is a higher altitude!

THREE

And a better attitude!

ONE begins to run manically around the clearing again, trying, unsuccessfully, to scramble up the rocks. THREE follows behind trying too, only with less skill and energy.

ONE

You know, what I would give for nature  
just this once to be on our side!

THREE

Oh God, we're working so hard for this  
tragedy.

ONE

Not hard enough evidently.

ONE pauses to catch their breath but then snaps their fingers.

ONE (cont'd)

I've got it. It was so obvious the whole  
time. We'll build a pyramid.

THREE

Yes! A pyramid so one of us can rise  
high enough to see what is going on.

ONE

(looking around)

We don't have a lot to work with here.  
We'll use our bodies.

SOLARITIES

ONE goes over to TWO and gently coaxes them back to the center of the clearing.

ONE (cont'd)

We can't do this without you.

TWO

Fine. But I'm not doing very much.

ONE

Fine. Just stand there, will you.

THREE

I should be on top. I have the best vision.

ONE maneuvers THREE next to TWO and begins to climb up their backs.

ONE

But you can't be trusted. You are constantly seeing and hearing things.

ONE clammers unsteadily to the top of the human pyramid, standing up, looking to the distance.

TWO

Is it me or is it getting darker?

THREE

It's only darker before the dawn.

ONE

Just lift me a little higher. I'm almost there.

TWO and THREE struggle to lift ONE even higher.

ONE (cont'd)

Higher! As high as you can, lift me! I'm  
seeing something now.

The unsteady pyramid sways and then collapses into a tangle of  
limbs and moans.

Recovering, THREE grabs ONE and shakes them.

THREE

Tell us! What did you see?

ONE

(breathless but with a  
strange air of confidence)

Twilight!

Curtain



## Tires

*Caroline Levander*

His mentor is a tree.

Because it has solar collectors. And harvests water with its roots and leaves. Because it puts out oxygen that creatures in the ecosystem transform into carbon dioxide. It is a perfect system—no waste, no refuse. That’s why, according to Mike Reynolds, renegade architect and founder of the earth-ship movement, no one says there are too many trees on the planet. But they do say that there are too many humans, way too many humans.

The new kind of habitation that Reynolds has termed “biotecture” looks to trees and their solarly for inspiration, as he told me when I spent the day interviewing him at his Taos, New Mexico Earthship Academy. Reynolds has been building his entirely off the grid earth-ships for the last forty-five years, first in Taos and then all over the world.

The biotecture communities that Reynolds and Academy alumni build are called “pockets of freedom” by their proud residents. Freed from the infrastructure that damages the earth, occupants claim membership in a movement that is about not just stopping global warming but actively reversing it. By repurposing garbage into building materials and developing innova-



Fig. 1. “Biotope House.” Photograph courtesy of Kevin E. Kirby.

tive design, the earth-ships, in Reynolds’s words, are “building vessels that enhance the planet we live on,” and that ultimately ensure that humankind will be able to “live forever on planet earth.”

The self-proclaimed garbage warrior looks at the earth from the vantage point of a visitor rather than an inhabitant. He described this transformation to me as a euphoric process that spanned about six months and involved a radical change of habitation. Living entirely alone in the northern New Mexico wilderness. Building a makeshift shelter out of the materials he found in the environment. Eating only what he could forage or kill. Reynolds’s experiment in self-reliance draws from a long tradition harkening back to Henry David Thoreau, but only to make a radical departure. Rather than glorifying the environment as a romantic landscape, the garbage warrior gradually adopted an alien perspective on planet earth. For a newcomer to earth, the sharp distinctions that humans make between refuse and resources would seem arbitrary. Why are old cans and bottles garbage but trees are highly prized building materi-





Fig. 2. “EarthShip Academy.” Photograph courtesy of Kevin E. Kirby.

als? Reynolds sees his surroundings like an alien would. And in the process, new opportunities lock into focus.

When he looks at piles of old tires, for example, he doesn’t see unsightly garbage like many of us would. Instead he sees “resources, natural resources.” “Tires grow here,” he told me. “They are indigenous to the entire planet. I can always find tires. There is no place I can go where I don’t find tires.” Which fits right in with his plan. “I’m after a design that can work all over the planet and materials that are available all over the planet.” But endemic to this design is the perspective of the alien, who perceives garbage that is made out of carbon black as a resource for off the grid habitation.

Made out of carbon black that draws from the sun, tires are the wheel on which the world’s global warming turns. Tires are about 30 percent carbon black, the sooty agent produced by partially burning fossil fuels. Responsible for warming the earth, absorbing sunlight and heating the atmosphere, carbon black is “grown” from the earth but, unlike the trees that Reynolds emulates, does not contribute to the earth’s wellbeing. And so we

might assume that he would not see the same life-giving properties in tires that he does in trees. But quite the contrary. Tires are the biggest and the single most ubiquitous natural resource that Reynolds sees when he looks at the planet like an outsider would, easily dwarfing bottles and cans. I asked Reynolds what he was going to do when he runs out of tires, and he just laughed like I was crazy. His answer: “We’ll cross that bridge if we ever get there — right now I see mountains of tires everywhere.”

And so, it comes as no surprise that the earth-ships’ most fundamental and prevalent building material would be old tires, pulled out of local dumps and landfills or taken directly off the hands of used car repair shops. The anatomy of a tire is predominantly carbon black, which comprises 70 percent of a tire’s composition. And that is because carbon black helps conduct heat away from the tread and belt area of the tire, reducing thermal damage and increasing tire life. So it makes sense that the man who takes inspiration from a tree would also see the thermal mass potential of tires differently. For the Earthship Academy, old tires filled by hand with compacted dirt create the ideal building block that stabilizes heating and cooling and remains wonderfully resistant to deterioration by the elements.

Each tire is filled on the building site, one person shoveling dirt in by hand while another person compacts the dirt with a sledgehammer while slowly walking around the tire to keep the dirt evenly dispersed. It’s a painstaking process that seems to harken back to pre-industrial times except for the fact of the tire itself.

These tires then become the single most important and prevalent material for biotecture’s thermal mass construction plan. Repurposed and weighing hundreds of pounds, they become building blocks for every earth-ship wall. More tires, used as “squishies,” are not filled with soil but wedged like grout between gaps in building construction to further tighten up space and make earth-ships more energy efficient.

Relying entirely on natural energy sources, the earth-ship design as a passive solar shelter uses thermal mass principles: the earth-filled tire walls soak up heat from the sun each day



*Fig. 3. “Thermal Mass Construction.” Photograph courtesy of Kevin E. Kirby.*

and then radiate that heat within the shelter at night. The thermal performance of each earth-ship is thus a dynamic balance between solar heat gain and the tire walls’ ability to collect, store, and transport that heat evenly to minimize indoor temperature fluctuation. When working optimally the tire walls create interior climates that are California-like in their uniform comfort and lack of temperature variability, despite outdoor daily temperature ranges that vary widely.

As a result, each earth-ship becomes an Edenic ecosystem in which temperature change is largely absent. The earth-ships’ domestic solarly gives warmth from the sun a new connotation, associated in residents’ minds with feelings of comfort, protection, freedom, and sustenance. Built out of the carbon-black rich tires that have warmed the earth, these domiciles reconstitute elemental solarly from the alien’s perspective. Tire replaces tree as a building material with the capacity to right the sunlight absorbing wrongs of its past life.

Not surprisingly, earth-ship communities are popping up all over the place: Haiti, South Africa, Australia, Argentina, Uru-

guay, France, Sweden, Denmark, Portugal, Spain, Estonia, the Czech Republic, Belgium, Portugal, and the list goes on. Reynolds says that he goes places where the regulation and rules against fully off the grid building are less stringent and where the demand is greater.

He recently developed an earth-ship app to encourage communities to build their own brand-compliant ships without Academy teams present. For under ten dollars you get a set of construction drawings which you take to get a building permit. There is also a materials list and how-to manual. The idea is to “get it out there cheap and easy” so that more and more communities will populate the planet and begin collectively to change the environmental collision course we seem to be on. Reynolds described his global plan as being “like a virus — we are going around the world sneezing and its catching.” Of course, he couldn’t know that within months the world would be brought to a grinding halt by a virus and that humans would be sheltering in place, only some of them insulated and comforted by tires with many more suddenly un-tired as long commutes became a thing of the past.

Still, Reynolds doesn’t imagine a world without cars and the tires that are his most important building material. In fact, he places a Tesla in the garage of every model earth-ship unit he opens to show people that they can live in an earth-ship and still drive to town for a taco and margarita without blowing their carbon footprint.

But it’s a far cry from his own ride, which is a 1976 Mercedes with a driver-side door made out of a repurposed refrigerator part. The smell of French fries and smoke hung in the desert air as he got out to shake my hand and apologize for being late to our interview. He’d had to fill up his tank at the local burger joint which sells him their used grease on the cheap. He laughed admitting that “it’s not the solution for everybody.” But, then again, he is the garbage warrior.

## Seaweed

*Sarah Besky*

Across the globe, as air temperatures steadily climb, so too do ocean temperatures. This rise is particularly acute in northern New England. Temperatures in the Gulf of Maine have risen nearly 2° Fahrenheit in the past century. This might not sound like much, in the past fifteen years, temperatures there have increased seven times more than in other parts of the world. This change is visualized in stark images: maps of dark and darker shades of red indicating heat intensity.<sup>1</sup> These images elicit imaginaries of the sun's rays literally cooking the near shore. In response to the warming gulf, once-plentiful species, lobsters most prominent among them, are moving to colder northern waters. With fewer and fewer lobsters to catch, lobster fishing in southern New England is no longer financially viable. Those still making a living off of the ocean must find different species to exploit. As New England fisheries collapse, seaweed — less finicky, it seems, about warming waters — offers a hopeful alternative.

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<sup>1</sup> Michael Carlowicz, "Watery Heatwave Cooks the Gulf of Maine," *NASA's Global Climate Change*, September 12, 2018, <https://climate.nasa.gov/news/2798/watery-heatwave-cooks-the-gulf-of-maine/>.

This turn from harvesting sea animals to harvesting sea vegetables is not unique to New England. From Maine to Madagascar, seaweed has been touted as a feed additive for cows to decrease methane emissions. It has been lauded as a biofuel, a superfood, and a carbon sink. Toothpaste and ice cream manufacturers use carrageenan to thicken their wares. Parents try to pass off snack packs of nori to their children as a substitute for potato chips. Major oil and gas companies are experimenting with microalgae as a cheap and renewable fuel source. Seaweeds of all shapes and sizes are being put to a dizzying array of uses and have become a cornerstone of the “green economy.” Seaweed’s slimy green potentiality makes it seem like a uniquely redeeming substance in an era of climate disaster. Seaweed is heralded by its proponents as a “low-input” form of food production, unlike its “high-input” terrestrial counterparts, which need water and fertilizers (often, an alarmingly large amount of both), along with a stratified labor process that moves plants from seed to plate. Seaweed just needs a bit of sunlight. The adoption of seaweed as a tool for healing the ocean and creating sustainable “green jobs” is shining a new light (forgive my solaripun) on regional political economies across the world.

Seaweed photosynthesizes, but don’t call it a “plant.” It’s algae. Algae lack the vascular systems and root structures of land plants. The life of algae, when compared to plants, however, is far more complicated than the mere lack of plant-like qualities. Without roots to keep it in place, seaweed is prevented from floating away by a “holdfast,” a root-like bundle that attaches to anything from rocks to boats to mollusks to floating ropes. While wild seaweed attaches to a variety of surfaces, farmed seaweed holds fast to long ropes (a proxy for those hard surfaces), which are strung under the surface of the water.

Seaweeds, then, hold fast underwater, but they need the sun. Some seaweeds have little air-filled pockets that allow them rise to towards the surface to catch more of the sun’s rays. Capital is thus accumulated in an elemental relationship between air, water, and sun.

The seaweed's holdfast is a biological response to solar-ity — an effort to remain in place while striving for sunlight. It is a tenacious structure that is also highly mobile. The term *holdfast* is etymologically kin to the nautical expression “Avast!” or “hold fast,” the order to remain in place while the seas gnash the ship. Seaweed itself, then, is a kind of holdfast. It allows a coastal economy to hold fast to the settler-colonial logics that fueled commercial fishing, extending them to the optimistic new frontier of “restorative ocean farming.”<sup>2</sup>

The sun places some limits on seaweed's expansion. Seaweed's need to photosynthesize shapes where and how it can grow. Seaweeds develop in such dramatic ways across their life cycles that different forms of the same algae have been mistakenly classified as distinct species. Algae range from one-celled phytoplankton to 100-foot long Giant Kelp. When we talk about “seaweed,” we usually mean those larger varieties that can be seen with the naked eye.

Much seaweed is not only edible but highly nutritious. From the coasts of China, Japan, and Korea to Maritime Canada, seaweeds have long been part of people's diets. Cookbooks and websites extoll the health benefits of eating seaweed from its mineral-rich qualities to its ability to act as an appetite suppressant. Popular accounts of the burgeoning industry ask, “is kelp the new kale?”<sup>3</sup>

Rockweed isn't one of those seaweeds that you'll find in the newest hipster grocery market. At least, you aren't likely to see “rockweed” on the food label. Rockweed is the stinky stuff that crunches under your feet on the shore at low tide. Bitter and slightly off-putting, rockweed is instead harvested for other commercial applications. Around Maine, it is used locally to pack lobsters and as a garden fertilizer, for which some harvest-

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- 2 Bren Smith, *Eat Like a Fish: My Adventures as a Fisherman Turned Restorative Ocean Farmer* (New York: Alfred A. Knopf, 2019).
  - 3 Nicola Twilley, Cynthia Graber, and Gastropod, “Kelp Is the New Kale,” *The Atlantic*, September 13, 2016, <https://www.theatlantic.com/science/archive/2016/09/gastropod-seaweed/499760/>.

ers claim they can yield about 20 USD a bushel (or 1000 USD a wet ton). It also appears in pet and livestock feed. Chemical extraction removes “alginate,” a compound used to thicken processed foods, cosmetics, and even paint.

Rockweed is also an ecology unto itself. Growing out from their holdfasts as they float toward the sun, clumps of rockweed create shady, cool canopies to create a home for a host of ocean life. Rockweed grows in the intertidal zone along the New England coast. These rockweed canopies ebb and flow with the tide, but the air-filled bladders ensure that even when the tide is at its highest, the plant can photosynthesize. In Maine, common law governing the intertidal zone derives from Massachusetts Bay Colony ordinances that permitted English settlers to move through the zone for purposes of navigation, fishing, or commerce. This means that the collection of any marine species from the intertidal zone is permissible, as long as the person doing the collecting is mobile, generally navigating a small boat, never affixing themselves to the rocky bottom.

Lunarity may govern the tides, but solarly governs how humans create value from tidal cycles. Or perhaps more accurately, changing coastal economies reframe the sun and the objects of its light into new forms of value and property. Those who can't make a living fishing any longer can, theoretically, harvest rockweed for sale. This has made the intertidal zone a new sort of commons, but not everyone is happy about this.

In Washington County, Maine, a remote rural coastal area, an active contingent of waterfront property owners filed a lawsuit in opposition to wild rockweed harvesting.<sup>4</sup> In a recent ruling, the state of Maine sided with the landowners (*Kenneth W. Ross et al., vs. Acadian Seaplants, Ltd.*, ME 45 [2019]). Settler property regimes sought to make a commons, but only for settlers themselves, out of the intertidal zone — , that part of the

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4 Christopher Burns, “Maine’s Top Court Rules You Can’t Pick Seaweed without a Property Owner’s Permission,” *Bangor Daily News*, March 28, 2019, <https://www.bangordailynews.com/2019/03/28/news/maines-top-court-sides-with-property-owners-in-dispute-over-rockweed-harvesting/>.



beach between the high and low tide marks. But contemporary coastal settlement envisions the near shore as a different kind of resource. These landowners now have the proprietary right to sun themselves on their private beaches and the proprietary control of all the rocks and mud in the intertidal zone, including the seaweed holding fast to those rocks.

Sunlight as warmth and sunlight as photosynthetic process are legally reframed. The enclosure of the commons, then, marks a restriction of solar energy's use value. Intertidal space, once legally framed to serve the needs of settlement, is once again recast to further the ends of private property. This perhaps foreshadows the future of the coastline in Maine, as waterfronts go from spaces to be worked on and with to spaces to be gazed upon. After all, the temporal frame for images of the Maine coast is the "golden hour," which as photographers know well is the period just after sunrise or just before sunset. The Washington County case ruling serves to filter out acts of extraction from the sun-inflected images of the rocky coastline.

But the market demand for edible seaweed continues to grow. So too does the conversion of sunlight into profit through aquatic photosynthesis. Across New England, university cooperative extension programs and private entrepreneurs are paying struggling lobster fishers to retrain as seaweed farmers. Instead of dropping a rope attached to a lobster pot into the water and pulling it back up again, seaweed farmers cast their ropes wrapped with algae cultures. Once those cultures have grown seaweed, they pull the ropes back up again. Seaweed farming, then, has been advertised as a means of rescuing lobstermen, the vast majority of whom are white men, from climate-induced precarity. But first, these fishers need aquaculture leases — to spaces beyond the intertidal zone — to set out their ropes. The coasts of New England are awash in recently approved and pending aquaculture permits, further extending territorial property regimes into the ocean.

Seaweed's solar energy does not just amplify the settler-colonial extractive logics and ontologies of property. While seaweed

promises a new salvation for the white male-dominated New England lobster fishery, development organizations in the Global South have been supporting seaweed as a means of women's empowerment for nearly thirty years. Beginning in the late 1980s, after the importation of seaweed species from the Philippines, women in Zanzibar began farming seaweed for export to the US and Europe where it is rendered into the thickener, carrageenan.<sup>5</sup> Here, farming doesn't require boats. Instead, women wade knee-deep in the water and tend to seaweed lines tied between sticks hammered into the ocean floor.

Development and environmental conservation agencies from the World Bank to The Nature Conservancy have rolled out seaweed programs. Development success stories describe pre-algae farming days on the Muslim-dominated island of Zanzibar, when women rarely left their houses. Thanks to seaweed, women are not only out of the house, but they have become financially independent from their male relatives.<sup>6</sup> With seaweed, families came to be able to afford schooling for their children or more durable material with which they could construct their houses. Stories from Madagascar, Indonesia, Mauritius, and the Philippines echo this narrative.<sup>7</sup>

As demand continues to increase, Indian Ocean water temperatures are also increasing — by an average of 1° Celsius in the last thirty years. Change is thus afloat in the subtropical seaweed industry. Warming waters have affected the seaweed harvest, causing long-term lulls in growth and die-off of the more

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5 Lucy Ash, "The Crop That Put Women on Top in Zanzibar," *BBC News*, July 3, 2018, <https://www.bbc.com/news/stories-44688104>.

6 Ibid., and Jacopo Passotti, "Madagascar: No More Fish? We'll Farm Seaweed Instead," *Deutsche Welle*, July 25, 2017, <https://www.dw.com/en/madagascar-no-more-fish-well-farm-seaweed-instead/a-39311040>.

7 Passotti, "Madagascar"; Imelda Albano, "Small-Scale Women Seaweed Farmers Ride the Rough Tides of Climate Change," *Mongabay*, June 3, 2019, <https://news.mongabay.com/2019/06/small-scale-women-seaweed-farmers-ride-the-rough-tides-of-climate-change/>; and Andi Hajramurni, "Farmers Rake in Profits from Seaweed," *The Jakarta Post*, July 23, 2018, <https://www.thejakartapost.com/news/2018/07/23/farmers-rake-profits-seaweed.html>.

lucrative varieties.<sup>8</sup> Further, thermal heating has given way to a form of blue-green algae that gives women harvesters blisters and rashes.<sup>9</sup> Many women have left the industry, but their need for an income can't be undone. Here we see an acute, gendered crisis of work that mirrors what's going on in New England. In New England, warming-induced lobster migration has made seaweed into a viable growth industry and a salvation for jobless men. But in the Global South, women's seaweed-fueled empowerment may be waning as seaweed goes the way of the lobster. Both these vulnerabilities can be traced to rising ocean water temperatures. Today, the most valuable species on Zanzibar that is flourishing in the sun's rays is the sunbathing tourist. Women now sell handicrafts and snacks to them between their shifts on a beach blanket.<sup>10</sup> Sun is a plentiful resource for the seemingly ever-expanding leisure industry to which unemployed fishers in New England and seaweed farmers in Zanzibar must turn. Here an obstacle, there a resource, now a danger, later a comfort, solar catalyzes human relationships to the ocean world in nonlinear ways.

Even if there is hope in a solar-fueled future, there is a simplistic purity in the sun as a beacon of the green economy. Low input farming and non-fossil fuel energy are certainly positive alternatives to the gas guzzling, fertilizer shoveling status quo, but it is important to consider the continuities across shifts from "extractive" to "regenerative." A greener economy, even if somewhat morally purified or environmentally sustainable, is still in the game of production. It's still an economy. Despite the seeming shininess and newness of solar's potentiality as an energy source, the economic grammar on which solar radiation is transformed into value is quite old. It is still an economy in which substitutions are being made without attention, perhaps,

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8 Karen Coates, "Warming Waters Hurt Zanzibar's Seaweed, But Women Farmers Have a Plan," *Christian Science Monitor*, May 21, 2018, <https://www.csmonitor.com/World/Africa/2018/0521/Warming-waters-hurt-Zanzibar-s-seaweed.-But-women-farmers-have-a-plan>.

9 Ash, "The Crop That Put Women on Top in Zanzibar."

10 Ibid.

to underlying structures of inequality and practices of dispossession. Seaweed for lobster, private space for public, solar power for fossil fuel. The settler logics of on- and off-shore extraction appear as “common sense.”<sup>11</sup> “Restorative.”

This economic grammar is even generic. Whether it is furthering the reach of settlement or rolled out as part of the development logics of “women’s empowerment,” solarify may reveal contiguities as much as it does novelties. Herein lies my interest in the holdfast. What is maintained? What is being held fast in these transitions?

It is not so much the solarify itself, but the relationship people have to solarify that reveals the settler colonial economic logics of the near shore. Holding fast is just one such relationship. On the world’s warming waterfronts, seaweed is not just a resource. It is a window onto the tension between holding fast or letting go of gendered forms of work and property, as well as a faith that there is — somewhere — an economic anchor amid planetary volatility.

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<sup>11</sup> Mark Rifkin, *Settler Common Sense: Queerness and Everyday Colonialism in the American Renaissance* (Minneapolis: University of Minnesota Press, 2014).

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## Black Atlantis

*Amelia Moore*

“The process of transmutation is what I am most interested in—from living entity to an object rich and strange whose natural home is the seabed, and which can withstand the elements underwater. This transition from living entity to corpse to the riches of the sea—pearls and coral—is an anthropocenic moment dissolving the human into nature, the living into something fossilized, but as an uneasy and radioactive fossilization.”

— S. Ayesha Hameed, “Black Atlantis: Three Songs”<sup>1</sup>

The Bahamas is an archipelagic nation on the western edge of the Caribbean. This region is my favorite place to consider solarly. These islands and seas speak with radiant energy. They tell us what is happening not because they are canaries in the coalmine of a dying world, but because they are intensely inventive sites of living, relating, and becoming. But sometimes their stories are hard to discern. That is because Bahamian stories are

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<sup>1</sup> S. Ayesha Hameed, “Black Atlantis: Three Songs,” in *Forensis: The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 712–18.

anti-disciplinary, requiring so much more than isolated understandings of island geology, marine biology, cultural studies, or history alone. This is a Bahamian story that begins with the sun before passing through the sea and near-shore coral reefs.

Imaginarities of the sun abound in the contemporary Caribbean. In The Bahamas, they are a large part of the corporate branding of the archipelago as a tourism destination for Euro-American travelers. You are certainly familiar with the branding of sun-sand-sea, also well known as “paradise discourse.”<sup>2</sup> Some of you have consumed these sun-drenched imaginaries on your own vacations or in your own travel fantasies. You may be less familiar with the sun produced within the rhetorics of climate mitigation science.<sup>3</sup> In The Bahamas, the ubiquitous sun has also become an emblem of photovoltaic solar power that can save the island nation from impending sea level rise and fossil fueled mass destruction.

These solar visions are interconnected. Sun-sand-sea mass tourism imaginaries appear to “naturally” uphold arguments about solar power as a techno fix for anthropogenic global warming. I have heard people in The Bahamas say, “the sun is a renewable resource we have in spades.” But connections that might at first appear to be common sense, upon inspection, prove to be linked through industries built on neocolonial and neoliberal foreign investment in the Bahamian economy, an economy that is frequently characterized as in *desperate need of development* and as lucrative in terms of offering a *substantive return on private investment*. Both the tourism and renewable energy industries are selling the Bahamian sun. This is the sun you have to buy as a branded commodity in international markets for sustainable travel. The colonization of the Caribbean sun is a fact that we largely take for granted.

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2 Ian Strachan, *Paradise and Plantation: Tourism and Culture in the Anglophone Caribbean* (Charlottesville: University of Virginia Press, 2002).

3 See Myles Lennon, “Postcarbon Amnesia: Toward a Recognition of Racial Grief in Renewable Energy Futures,” *Science, Technology, and Human Values* 45, no. 5 (2020): 934–62.



Because this is a volume on solarly as a form of material relationality stemming from the sun as the source of planetary energy, I want to explore how more expansive relational thinking about the sun might extend our story. Solarly, when enmeshed with complimentary forms of relational thinking, might lead us down a different path. In some instances, the sun in The Bahamas is not just a brand to be sold and consumed or a “natural resource” to be exploited, sustainably or unsustainably. Solarly can instead be understood as an ethic and as an escape from the overdetermining colonial and supremacist orderings of the world. In my head, solarly hesitantly meshes with Black feminist conceptions of history, power, being, and becoming. Solarly can then, following Zakiyyah Iman Jackson, participate with Black studies in “rethinking ontology: our being, fleshy materiality, and the nature of what exists and what we can claim to know about existence.”<sup>4</sup> Solarly, when allied to this mode of creatively thinking otherwise, can help us to imagine against “colonial mode(s) of aesthetico-affective-cognition.”<sup>5</sup>

For example, solarly can and should encompass vast swaths of spatial, temporal, material, and political interaction. Can we hold all this together in our minds? Solarly might be able to help render tangible the relationship between radiant subtropical sunlight, the extensive shallow seas of the Caribbean region, the evolution of coral reefs dependent on symbiotic relationships with photosynthetic life forms, the emergence of sand from reef ecosystems that renew and breakdown coral skeletons over millennia creating dunes, beaches, and even the limestone substance of the Bahamian islands themselves,<sup>6</sup> islands that were once home to Indigenous populations of migrating people such as Lucayans, Arawaks, and Caribs who witnessed the arrival of Columbus in 1492 and experienced the subsequent

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4 Zakiyyah Iman Jackson, *Becoming Human: Matter and Meaning in an Antiblack World* (New York: New York University Press, 2020), 1.

5 *Ibid.*, 126.

6 See Vanessa Agard-Jones, “What the Sands Remember,” *GLQ: A Journal of Lesbian and Gay Studies* 18, no. 2 (2012): 325–46.

imposed violence of European imperial and colonial seaports and plantations. These islands also become home to so many members of the African diaspora via strategic and violent kidnapping to uphold the sun-sand-sea economies of the colonial and then neocolonial eras, economies that contributed their own small but significant part to what we now understand to be global warming, sea level rise, and mass coral death. These processes lead to the twenty-first century solutions of renewable energy transition, sustainable tourism, and even coral restoration ventures.

Coral restoration in The Bahamas is the specific focus for the rest of my story. Coral restoration is assumed to be an obvious good, but solarity shines a different light on this trend. I now see most coral restoration ventures as a manifestation of colonial-corporate sun, but I also see some ventures as experiments that might embody a potentially liberatory form of solarity.

Here are three brief examples of coral restoration as a manifestation of colonial-corporate sun:

*Coral Vita*: Coral Vita is a young company on the island of Grand Bahama, “founded” by two graduates of Yale University’s environmental masters program who see themselves as entrepreneurs in the global blue economy. Their business plan is, first, to grow large numbers of micro-fragmented “super coral” (coral adapted to extreme heat conditions) in fields of nursery tanks on the island and, second, to sell those coral fragments to various clients who want to create coral restoration projects around the region for various reasons. The Coral Vita website explains that potential clients include “resorts and eco-tourism operators,” “governments and marine park managers,” “damage repair and mitigation banking,” “other restoration organizations,” “concerned citizens and communities,” and “corporations and foundations.”<sup>7</sup>

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7 “Restoring Our World’s Dying Coral Reefs,” *Coral Vita*, n.d., <https://www.coralvita.co/>.

*MSC Cruises Ocean Cay:* MSC is an international cruise ship company with origins in the Mediterranean that has leased an island from the Bahamian government (formerly the site of an industrial sand mine operation) in order to build a private island cruise ship destination to host cruise travelers from Florida. The island is now located within a marine reserve sponsored by MSC. In addition to tourists, the reserve hosts research partners from the University of Miami and Nova Southeastern who have signed on with MSC to build an on-site coral nursery and to develop a coral restoration model to show their paying guests. This was announced in 2021 as another super-coral-growing program.

*Bahamar Resort:* Beginning with reef ball deployment right offshore of their New Providence mega resort in 2014, the Bahamar multi-hotel complex has been experimenting with branding coral conservation for several years. Their latest effort appears to be a partnership with the local ENGO BREEF in which paying guests of the ultra luxury Rosewood Hotel can pay a little more to adopt a coral and to take an excursion to snorkel over BREEF's underwater sculpture garden. The coral fragments "adopted" by hotel guests will be grown in BREEF's own coral nursery to be outplanted around the sculpture garden over time.

These three examples of colonial-corporate sun (in this case manifested through coral restoration ventures) all rhetorically invoke the need to participate in economies of survival amidst a planetary crisis. They all claim in their public relations materials to be investing in coral for the future of local people, humanity in general, and the sustainability of the global environment. But these are also all foreign-owned enterprises, their corporate leaders are all white and mostly male Euro-Americans (when named or made visible at all), and they are all for-profit companies even if they leverage non-profit organizations to enhance their products. These three multinational companies have all

very publicly invested in turning coral restoration into a scalable business model that they each claim to be “pioneering” in The Bahamas. The relations evidenced in these examples of colonial sun are avaricious, colonizing, and extractive. They flatten or erase local and regional history, politics, and place. We can read them as an extension of petrocultural orientations to industrial world making. Sun-sand-sea brands, super coral as a new biotech product, elite-guest excursions, and corporate-client choices all work together to keep expanding the blue economy in a world in which most non-commodified tropical coral will experience increasingly precarious conditions and highly uneven outcomes.<sup>8</sup> I do not find much hope in these examples.

I do find some *imperfect hope* in an example that I interpret as an invitation to reject supremacy in restoration ecology. I have been following the work of a young Bahamian woman and marine conservation activist for many years, Nikita Shiel-Rolle. Nikita has marine science degrees from American and European universities, and she has spent years working on multinational, regional, and national conservation policy development. She has been a small-island organizer for the United Nations as well as an environmental educator in The Bahamas. But after Hurricane Dorian hit the archipelago, eviscerating infrastructure on two major islands resulting in far too many dead and missing persons, Nikita has shifted her life mission to focus on preparing residents of one Bahamian island, Cat Island, to become professional marine scientists, under the banner of what she calls “ocean love.”

On Cat Island, you can still find the remnants of slave-holding plantations in the bush. Some people describe this island as “the most Bahamian” of all the islands in the country because islanders famously retained their oral storytelling traditions, music, and religious practices that tied them to old-world Africa for many generations. Cat Island is too far from the international airport on New Providence to readily attract mass tourist

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8 See Terry P. Hughes et al., “Coral Reefs in the Anthropocene,” *Nature* 546 (2017): 82–90.

numbers, and it has no major cruise terminal. And residents do not typically return to this rural island if they pursue higher education because stable economic opportunities are few and far between, primarily having only limited employment in the small-scale tourism industry or commercial fishing. But Nikita sees possibility in this quiet place: why shouldn't local Cat Islanders become their own experts, fulfilling their own science diving and submarine ecological assessment needs? She says that she wants to foster, from the ground up, a community of ocean guardians who will manage their own marine resources and who will be skilled in marine consultation as a professional trade. Coral restoration is on the list of skills she plans to develop within the Cat Island community.

Nikita told me recently about her attempts at building a coral nursery on Cat Island. She knew how to set up a pilot stand of coral trees (submerged vertical scaffolds on which coral fragments are placed in order to grow large enough for out planting into reef areas) using an essentially DIY system that is low budget and involves readily available materials. She put a few trees made from PVC pipe and fishing line in a suitable offshore location, and she hoped she could engage islanders to assist with monitoring and maintenance. But the sheer labor required took her by surprise. Cleaning algae off the attached coral fragments took many hours a week that she had not budgeted for herself, and checking on the nursery was a daily task. The trees were susceptible to storm and wave action, and changes in ocean temperature could wreak havoc on the fragments. Coral died. Trees disappeared. She was physically and emotionally exhausted by the endeavor. She had limited funds to hire more people to support the effort, and her nascent community of ocean guardians wasn't large enough or advanced enough to fully take on all the labor themselves. So she has had to abandon this first attempt at community coral restoration. She told me all this with a big sigh when we last saw one another in person. Perhaps she will try again in the future when the island has a more established group of local community conservation practitioners.



Fig. 1. “Human Coral Hybrids.” Sculpture and photograph by Tamika Galanis, 2017, used with permission.

I consider this tiny example of Nikita’s attempt at small-scale, non-commercial coral restoration in Cat Island to be a glimpse of something like a Black Atlantis, imagined and materialized through solarify.<sup>9</sup> Unlike the “Blue Economy” which promotes the continued exploration, exploitation, and extraction of marine resources as an engine of economic development,<sup>10</sup> I intend “Black Atlantis” to refer to an imperfect process by which marine restoration, in this case via coral reefs, anchors emergent and resistant materialities of knowing and being in the Caribbean. Art helps us to feel the meaning of the concept.

In reference to her work, pictured here, Bahamian artist Tamika Galanis explains that “*Human-Coral Hybrids* are a requiem for the invisible: both the Africans forced across the Middle Passage establishing the Diaspora to the Caribbean and present-day-Bahamians.”<sup>11</sup> Another example comes from the work of the American artist Ellen Gallagher. Her *Coral Cities* (2007)

9 For a brilliant discussion of art, literature, history, and dystopian possibility for the planet, see Hameed, “Black Atlantis.”

10 See P.G. Patil et al., *Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean* (Washington, DC: World Bank, 2016).

11 Tamika Galanis, “Human-Coral Hybrids,” *Tamika Galanis*, n.d., <https://www.tamikagalanis.com/human-coral-hybrids>.

and *Watery Ecstatic* (2004) series depict submarine beings that merge human and marine life in a fluid, dream-like cosmology tinged with a sense of mystery. According to Gallagher, these images “explore the myth of Drexciya, a myth propagated by an underground Detroit techno outfit of the same name in the 1990s. An Atlantis-like underwater world, Drexciya is populated by a marine species descended from women and children who jumped overboard or were thrown from slave ships during the grueling journey from West Africa to America.”<sup>12</sup>

I learned of Gallagher’s artwork in Katherine McKittrick’s book about Black Studies, *Dear Science*.<sup>13</sup> McKittrick muses on Drexciya and Black creativity as “all at once, resistance, critique, method-making, praxis, and a site of neurological and physiological experience.”<sup>14</sup> She is talking about art and music, but I have begun to see the Cat Island ocean guardians and Nikita’s plans for home-grown ocean love as a form of explicitly Black creativity with living solarly. McKittrick argues that “one thing black creative praxes do is illuminate narratives of black life and humanity and, at the same time, create conditions through which relationality, rebellion, conversation, interdisciplinarity, and disobedience are fostered.”<sup>15</sup> She is looking for those people like Nikita who “provide intellectual spaces that define black humanity outside colonial scripts”<sup>16</sup> and “disrupt disciplined ways of knowing,”<sup>17</sup> and she wants to “to honor these voices as brilliant and intellectual method-making.”<sup>18</sup>

In my read of the events taking place in the shallow seas around Cat Island, there is just this kind of radical potential in coral restoration experiments. Photosynthesizing solarlyans—both coral

12 Ellen Gallagher, “Watery Ecstatic Series,” *The Broad*, n.d., <https://www.thebroad.org/art/ellen-gallagher/watery-ecstatic-series>.

13 Katherine McKittrick, *Dear Science and Other Stories* (Durham: Duke University Press, 2020).

14 *Ibid.*, 51.

15 *Ibid.*

16 *Ibid.*, 52.

17 *Ibid.*, 56.

18 *Ibid.*, 57.

and Cat Islanders — might be nurtured together in labor-intensive projects based on non-commodified, non-colonized, non-corporatized ocean love. This as yet mostly imagined Black Atlantis embodies the ongoing struggle for sovereignty and autonomy on a changing planet in direct denial of the allure of colonial-corporate sun. Such rare examples of community-grown and -centered coral restoration projects are a form of Black ecology,<sup>19</sup> and as such they are also an ethic, a movement, and a method for making solar futures. Right now, such projects are so very hard to build and maintain, and yet I hope we never lose our ability to imagine the creation of something more.

### Coral

This coral' s shape echoes the hand  
It hollowed. Its

Immediate absence is heavy. As pumice,  
As your breast in my cupped palm.

Sea-cold, its nipple rasps like sand,  
Its pores, like yours, shone with salt sweat.

Bodies in absence displace their weight,  
And your smooth body, like none other,

Creates an exact absence like this stone  
Set on a table with a whitening rack

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19 See J.T. Roane and Justin Hoseby, "Mapping Black Ecologies," *Current Research in Digital History* 2 (2019), <https://crdh.rchnm.org/essays/v02-05-mapping-black-ecologies/>.



Of souvenirs. It dares my hand  
To claim what lovers' hands have never known:  
  
The nature of the body of another.<sup>20</sup>

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20 Derek Walcott, "Coral," in *Collected Poems, 1948–1984* (New York: Farrar, Straus, and Giroux, 1987), 73.

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## Author Biographies

**Ian J. Alexander** is a writer and educator from Clarion County, Pennsylvania. He studies the history of the us prison regime, revolutionary and abolitionist prisoners' movements, and media histories. In his research, he approaches media and media technologies as sites of struggle inside prisons and across prison walls. By looking at technologies such as radio, television, mail, digital tablets, telephones, and isolation chambers variously as tools of oppression, reform, and liberation, his work brings critical prison studies and abolitionist methods together with media studies and media history. Ian is currently a visiting lecturer in the Department of American Studies at Wellesley College.

**Gretchen Bakke** holds a Heisenberg Position at the Institute for European Ethnology and the Institute for Human-Environment Transitions at Humboldt University, Berlin and is a Visiting Fellow at the Max Planck Institute for the History of Science, also in Berlin. Bakke is the author of *The Grid: The Fraying Wires Between Americans and Our Energy Future* (Bloomsbury, 2016), a 2016 Bill Gates pick, and the ebullient 2020 ethnography *The Likeness: Semblance and Self in Slovene Society*. She is currently conducting research for a cultural history of the end of fossil

fuels in and around the North Sea, leading The Global Mollusc Project at the Research Institute for Sustainability in Potsdam, Germany and writing a series of very serious essays, collectively know as *Minor Analytics*.

**Daniel A. Barber** is Professor of Architecture at the University of Technology Sydney (UTS). His research focuses on environmental dimensions of architecture's past, present, and future. More recent publications include *Modern Architecture and Climate: Design before Air Conditioning* (Princeton University Press, 2020), the article "After Comfort" (*Log* 47, 2019), and *A House in the Sun: Modern Architecture and Solar Energy in the Cold War* (Oxford University Press, 2016). Daniel has held academic positions and fellowships at Harvard, Penn, Princeton, and Yale, at the Instituto Universitário de Lisboa, the Max Planck Institute (Berlin), Rachel Carson Centre (Munich), and most recently as a Senior Research Fellow at the Centre for Apocalyptic and Post-Apocalyptic Studies (CAPAS) at the Universität Heidelberg. He received a 2022–23 Guggenheim Fellowship for his project Thermal Practices. Daniel co-edits *Accumulation*, an annual dossier of essays on the *e-flux architecture* online platform. He is the co-founder of the Current Collective for Architecture and Environmental History and is on the editorial board of the *Journal of Architecture* and *Fabrications*. He lectures globally, encouraging architects and others to consider their creative practice in the context of the climate emergency.

**Sarah Besky** is an anthropologist and Associate Professor in the Industrial and Labor Relations School at Cornell University. She is the author of *The Darjeeling Distinction: Labor and Justice on Fair-Trade Tea Plantations in India* (University of California Press, 2014) and *Tasting Qualities: The Past and Future of Tea* (University of California Press, 2020), as well as the co-editor of *How Nature Works: Rethinking Labor on a Troubled Planet* (SAR Press, 2019). Her current research examines the past and present of small-scale farming in India's eastern Himalayas.

**Amanda Boetzkes** is Professor of Contemporary Art History and Theory at the University of Guelph. Her research focuses on the relationship between perception and representation, theories of consciousness, and ecology. She has analyzed complex human relationships with the environment through the lens of aesthetics, patterns of human waste, and the global energy economy. She is the author of *Plastic Capitalism: Contemporary Art and the Drive to Waste* (MIT Press, 2019), *The Ethics of Earth Art* (University of Minnesota Press, 2010), and a forthcoming book titled *Ecologicity: Vision and the Planetarity of Art*. Co-edited books include *Artworks for Jellyfish (And Other Others)* (Noxious Sector, 2022), *Heidegger and the Work of Art History* (Routledge, 2014), and a forthcoming volume on *Art's Realism in the Post-Truth Era* (Edinburgh University Press, 2024). Currently, she is the principal investigator of *At the Moraine*, a multi-year, collaborative research project that studies the mediation and representation of global climate change, with a special focus on Indigenous territories of the circumpolar North.

**Dominic Boyer** is an anthropologist, media maker, and environmental researcher who teaches at Rice University where he served as Founding Director of the Center for Energy and Environmental Research in the Human Sciences (2013–19). His most recent books are *Energopolitics* (Duke University Press, 2019), which analyzes the politics of wind power development in Southern Mexico, and *Hyposubjects* (Open Humanities Press, 2021), an experimental collaboration with Timothy Morton concerning politics in the Anthropocene. With Cymene Howe, he made a documentary film about Iceland's first major glacier (Okjökull) lost to climate change, *Not Ok: A Little Movie about a Small Glacier at the End of the World* (2018). In August 2019, together with Icelandic collaborators, they installed a memorial to Okjökull's passing, an event that attracted media attention from around the world and which caused *The Economist* to create their first-ever obituary for a non-human. His next book is titled *No More Fossils* (University of Minnesota Press, 2023),

a discussion of fossil fuel fossils and what is to be done about them.

**Cara New Daggett** is an Associate Professor in Political Science at Virginia Tech and a fellow at the Research Institute for Sustainability, Potsdam, Germany (2023–2024). Her research explores energy and ecological politics through a feminist framework. Her award-winning book, *The Birth of Energy: Fossil Fuels, Thermodynamics, and the Politics of Work* (Duke University Press, 2019) investigates how the 19th-century science of energy informed Anglo-European empires by intensifying racist and patriarchal labor systems. More recently, her work explores the intersection of misogyny and intensive energy use, most notably in petro-masculinity among right-wing movements. With two colleagues, Christine Labuski and Shannon Bell, she formed the Mayapple Energy Transition Collective with the goal of envisioning feminist energy systems. Her work has been published in journals including *Environmental Politics*, *Millennium: Journal of International Politics*, and *Energy Research & Social Science*.

**Jason De León** is a Professor of Anthropology and Chicana, Chicano, and Central American Studies at the University of California, Los Angeles and Executive Director of the Undocumented Migration Project, a non-profit organization focused on raising awareness about issues related to clandestine migration and assisting families of missing migrants searching for their loved ones. De León is Head Curator of the ongoing global exhibition “Hostile Terrain 94” and author of *The Land of Open Graves: Living and Dying on the Migrant Trail* (University of California Press, 2015). His most recent book *Soldiers and Kings: Survival and Hope in the World of Human Smuggling* will be published by Viking Press in 2024.

**Jeff Diamanti** is Assistant Professor of Environmental Humanities (Cultural Analysis & Philosophy) at the University of Amsterdam. In 2016–17 he was the Media@McGill Postdoctoral



Fellow in Media and the Environment where he co-convened the international colloquium on Climate Realism, the results of which appear in a volume he co-edited, *Climate Realism: The Aesthetics of Weather and Atmosphere in the Anthropocene* (Routledge, 2020) and a double issue of *Resilience*. His first book, *Climate and Capital in the Age of Petroleum: Locating Terminal Landscapes* (Bloomsbury, 2021), tracks the political and media ecology of fossil fuels across the extractive and logistical spaces that connect remote territories like Greenland to the economies of North America and Western Europe. His new research, *Bloom Ecologies*, details the return to natural philosophy in the marine and atmospheric sciences, studying the interactive dynamics of the cryosphere and hydrosphere in the North Atlantic and Arctic Ocean. He co-directs the ASCA Political Ecologies Seminar with Joost de Bloois, and with Amanda Boetzkes, he co-organizes “At the Moraine,” an ongoing research project on the political ecology of glacial retreat in the Arctic. With Fred Carter, he co-directs the FIELDARTS arts and science residency in Amsterdam, Netherlands.

**Kim Förster** is an architectural historian, teaching and researching at the University of Manchester as a member of MARG (Manchester Architecture Research Group). Having earned his doctorate in architecture at ETH Zurich in 2011, he was Associate Director of Research at the Canadian Centre for Architecture from 2016 to 2018, where he led the multidisciplinary research project “Architecture and/or the Environment” as part of the Andrew W. Mellon Foundation’s “Architecture, Urbanism, and the Humanities Initiative.” He taught at ETH’s Institute gta, in the Doctoral Program for the History and Theory of Architecture, and as a visiting professor at EPFL Lausanne. His research and teaching focus on an environmental, energy, and material history, particularly a global history of cement. Förster has published on environmental topics in *Architectural Histories*, *Candide*, *Werk, Bauen + Wohnen*; he contributed to the *Routledge Companion to Architecture and Social Engagement* (Rout-

ledge, 2018), to *Überbau: Produktionsverhältnisse der Architektur im Anthropozän* (Universitätsverlag TU Berlin, 2021), and to *Beyond Concrete* (Triest Verlag, 2022). A member of the collective common room, in 2022 Förster co-curated “Disquietude: Architecture and Energy in Portugal” and co-edited a book with the same title. Förster edited the “Environmental Histories of Architecture” series for the CCA (Library Stack, 2022–23).

Described as a “chameleon” by Carlo McCormick in the *New York Times*, **Ganzeer** operates seamlessly between art, design, and storytelling, creating what he has coined: Concept Pop. His medium of choice according to *Artforum* is “a little bit of everything: stencils, murals, paintings, pamphlets, comics, installations, and graphic design.” With over forty exhibitions to his name, Ganzeer’s work has been seen in a wide variety of art galleries, impromptu spaces, alleyways, and major museums around the world, such as The Brooklyn Museum in New York, The Palace of the Arts in Cairo, the Moody Center for the Arts in Houston, and the V&A in London. Ganzeer’s current projects include a short story collection titled *Times New Human* and a sci-fi graphic novel titled *The Solar Grid*, an elaborate work-in-progress which has awarded him a Global Thinker Award from *Foreign Policy* in 2016. He has been an artist-in-residence in Germany, Poland, Jordan, the Netherlands, and Finland, and has lived extensively in Cairo, New York, Los Angeles, Denver, and finally Houston — where he is now based.

**Mél Hogan** is the host of *The Data Fix* podcast and is the Director of the Environmental Media Lab (EML). She is an Associate Professor in the Department of Film and Media at Queen’s University (Kingston, Ontario). Her research focuses on data infrastructure, understood from within the contexts of settler-colonial extractivism, planetary catastrophe, and collective anxieties about the future.

**Aster Hoving** is a doctoral researcher in Environmental Humanities with the Greenhouse Center for Environmental

Humanities at the University of Stavanger. Her PhD project “Ocean Energies” investigates how energy companies, scientists, and artists engage with the ocean’s energies. Previously, Aster studied at Utrecht University, the University of Amsterdam, University of California, Berkeley, and New York University. Her master’s thesis “Elemental Aesthetics” received the University of Amsterdam Faculty of Humanities Thesis Prize 2021 and in 2023 she was awarded the inaugural British Council Scotland SGSAAH EARTH Scholarship for research at the University of Glasgow. Aster’s published work can be found on the website *Environmental History Now* (2021).

**Cymene Howe** is Professor of Anthropology at Rice University with a longstanding interest in how people and environments co-create one another. Her field research in the Americas (Nicaragua, Mexico, United States) the Arctic (Iceland, Greenland), and coastal cities (Cape Town and Honolulu) illustrates a widening field of human imprint on ecosystems. Her current research focuses on the interconnections between a melting Arctic and sea level rise in global coastal cities, with an attention to how water, transformed by a warming world, establishes novel links between distant places and populations. Her books include *Intimate Activism: The Struggle for Sexual Rights in Postrevolutionary Nicaragua* (Duke University Press, 2013) and *Ecologics: Wind and Power in the Anthropocene* (Duke University Press, 2019) as well as two edited collections: *Anthropocene Unseen: A Lexicon* (punctum books, 2020) and *The Johns Hopkins Guide to Critical and Cultural Theory*. She co-produced the documentary film *Not Ok: A Little Movie about a Small Glacier at the End of the World* (2018) and was co-creator of the Okjökull memorial event in Iceland, the world’s first funeral for a glacier fallen to climate change.

**Tim Ingold** is Emeritus Professor of Social Anthropology at the University of Aberdeen. Following 25 years at the University of Manchester, where he was appointed Max Gluckman Professor of Social Anthropology in 1995, Ingold moved in 1999 to Aber-

deen, where he established Scotland's youngest Department of Anthropology. Ingold has carried out ethnographic fieldwork among Sámi and Finnish people in Lapland, and has written on comparative questions of environment, technology, and social organization in the circumpolar North, the role of animals in human society, issues in human ecology, and evolutionary theory in anthropology, biology, and history. He has gone on to explore the links between environmental perception and skilled practice, replacing traditional models of genetic and cultural transmission with a relational approach focusing on the growth of bodily skills of perception and action. Ingold's current interests lie on the interface between anthropology, archaeology, art and architecture. His recent books include *The Perception of the Environment* (Routledge, 2000), *Lines* (Routledge, 2007), *Being Alive* (Routledge, 2011), *Making* (Routledge, 2013), *The Life of Lines* (Routledge, 2015), *Anthropology and/as Education* (Routledge, 2018), *Anthropology: Why It Matters* (Wiley, 2018), *Correspondences* (Wiley, 2020), and *Imagining for Real* (Routledge, 2022). Ingold is a Fellow of the British Academy and the Royal Society of Edinburgh. In 2022 he was made a CBE for services to Anthropology.

**Bob Johnson** is author of *Carbon Nation: Fossil Fuels in the Making of American Culture* (University Press of Kansas, 2014) and *Mineral Rites: An Archaeology of the Fossil Economy* (Johns Hopkins University Press, 2019). He is a Professor of History who has written widely on American culture, theory, and the environment with his work centered on the double helix of global warming and social justice. His current book project, "The Colonial Climate: How We Made (and Un-Made) the World's Most Perfect Climate in San Diego, California, 1846-," reconsiders the Southern California climate through the lens of actor-network theory in an effort re-position climate change as a product of colonial relations. He lives with his family in San Diego, California, home to the highest concentration of urban military assets in the world and what local marketers call "America's Finest City."

**Aylin Kuryel** is an Assistant Professor in the Literary and Cultural Analysis department at the University of Amsterdam. Her research areas are nationalism, image politics, aesthetics/resistance, and politics of emotions. She is the co-editor of *Cultural Activism: Practices, Dilemmas and Possibilities* (Rodopi, 2010), *Resistance and Aesthetics in the Age of Global Uprisings* (*Küresel Ayaklanmalar Çağında Direniş ve Estetik*, Iletisim Press, 2015), *Being Jewish in Turkey: A Dictionary of Experiences* (*Türkiye'de Yahudi Olmak: Bir Deneyim Sözlüğü*, Iletisim Press, 2017), and *Essays on Boredom* (*Sıkıntı Üzerine Denemeler*, Iletisim Press, 2020). She has been involved in projects as an artist and is working as a documentary filmmaker. Among her documentaries are *Translating Ulysses* (2023), *A Defense* (2021), *CemileSezgin* (2020), *The Balcony and Our Dreams* (2020), *Heads and Tails* (2018), and *Welcome Lenin* (2016).

**Myles Lennon** is an environmental anthropologist, Dean's Assistant Professor of Environment & Society and Anthropology at Brown University, and a former sustainable energy policy practitioner. His first research project explores the intersectional dimensions of solar infrastructure in New York City, illuminating the sensorial and emotional power of renewable energy in a gentrifying skyline built on racial capitalism and threatened by climate collapse. He is currently conducting long-term research on young, Black land stewards' complex efforts to navigate settler colonialism and redress white supremacy through land-based labor in the United States. His research has been supported by the US National Science Foundation, the Ford Foundation, and the Wenner-Gren Foundation.

**Caroline Levander** holds an endowed chair in the humanities at Rice and serves on Rice University's senior leadership team as a vice president. As the author of five books and numerous articles on American cultural history, she has deep expertise on the long history and politics of American life. Her leadership portfolio focuses on educational innovation, strategic growth, new revenue streams, and digital transformation, all with a

focus on global impact. Beyond Rice, she serves on numerous ed tech advisory boards, including the Coursera Council and 2U/EdX Advisory Council, and is Vice Chair of the Fulbright Association Board of Directors. The ed tech company that she co-founded in 2020 was acquired by Honor Education in 2022 where she is a senior advisor.

**Amelia Moore** is an Associate Professor of Marine Affairs at the University of Rhode Island. She has degrees in Environmental Biology from Columbia University and Sociocultural Anthropology from the University of California, Berkeley. Her research involves the social role of islands in ecological and environmental knowledge production, and she approaches this topic through the lens of antiracist, anticolonial, feminist science and technology studies, and Black ecologies.

**Cristián Simonetti** is Associate Professor in Anthropology at the Pontificia Universidad Católica de Chile. His work has concentrated on how bodily gestures and environmental forces relate to notions of time in science. More recently he has engaged in collaborations across the sciences, arts, and humanities to explore the environmental properties of materials relevant to the Anthropocene. He is the author of *Sentient Conceptualizations: Feeling for Time in the Sciences of the Past* (Routledge, 2018), co-editor of *Surfaces: Transformations of Body, Materials and Earth* (Routledge, 2020), and co-editor of a special issue of the journal *Theory, Culture & Society* entitled “Solid Fluids: New Approaches to Materials and Meaning” (2022).

**Nicole Starosielski**, Professor of Media at New York University, is author or co-editor of over thirty articles and five books on media, infrastructure, and environments, including *The Undersea Network* (Duke University Press, 2015), *Media Hot and Cold* (Duke University Press, 2021), *Signal Traffic: Critical Studies of Media Infrastructure* (University of Illinois Press, 2015), *Sustainable Media: Critical Approaches to Media and Environ-*

*ment* (Routledge, 2016), and *Assembly Codes: The Logistics of Media* (Duke University Press, 2021), as well as co-editor of the “Elements” series at Duke University Press. Starosielski’s most recent project involves working with the subsea cable industry—which lays the transnational links of the internet—to make digital infrastructures more sustainable.

**Hannah Tollefson** is a PhD candidate in Communication Studies at McGill University. Informed by environmental humanities and media and technology studies, her research examines infrastructure and environment, with a focus on extraction, logistics, and energy. Her doctoral project is a study of how the shores and waters of the Salish Sea surrounding the Port of Vancouver have been constructed, maintained, and contested as a space of circulation.

**Ayesha Vemuri** is a PhD candidate in Communication Studies at McGill University. Her doctoral research lies at the intersection of climate change, migration, infrastructure, and feminist science and technology studies. She is interested in the ways in which experts construct and manage the risk of floods and migration in the context of climate change in Assam, India. Her research examines how the management of the river, and its annual floods, intersects with other key industries in Assam, including oil and natural gas, sand mining and construction, conservation, and border management.

**Rhys Williams** is a senior lecturer in Energy & Environmental Humanities at the University of Glasgow. His research focuses on the politics and poetics of infrastructure, energy, and food futures. He’s recently published in *South Atlantic Quarterly*, *Open Library of Humanities*, and the *New Routledge Companion to Science Fiction*.









