

**Accumulation: The Art, Architecture,
and Media of Climate Change**

Nick Axel, Daniel A. Barber, Nikolaus Hirsch,
Anton Vidokle, Editors

e-flux architecture

The background of the cover is a solid, vibrant red. Overlaid on this are several thick, white, curved lines that intersect to form a series of overlapping, organic shapes. These lines are reminiscent of architectural arches or perhaps the paths of particles in a dynamic system, creating a sense of movement and interconnectedness. The lines are smooth and continuous, with some crossing each other to form smaller, more complex shapes.

Accumulation

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Introduction

The climate is not the weather. Weather can be experienced, but to understand climate, media is necessary. As the computational capacity to manage meteorological data emerged in the middle of the twentieth century, so did the means of visualizing and disseminating these new forms of complex information. Scientific knowledge of global and regional climate systems has been advanced through expressive, technical, and speculative images. Media provide access to processes of accumulation that are endemic to the contemporary socio-biotic condition of climate instability. If media do not precisely determine our situation, following the work of twentieth-century media theorist Friedrich Kittler, they nonetheless provide access to the material and cultural outlines of possible futures.

The current epoch is one of accumulation: not only of capital (primitive or otherwise) but also of raw, often unruly material ranging from people, buildings, and cities to plastic in the ocean, carbon in the atmosphere, and viral loads in the air and in the lungs. It is an epoch of accumulating anxiety and a collective recognition of the difficulty of finding effective means for intervening in the behaviors and practices that engender these seemingly intractable patterns of growth.

Alongside these material accumulations, images of accumulation are everywhere, from reports by the International Panel on Climate Change and news media platforms chronicling the spread of wildfires, floods, and excessive heat to stock market tickers indexing skyrocketing

economic inequities. Meanwhile, discussions of degrowth, of retrofiting and moratoria on new construction, and novel modes of horizontal distribution struggle to take hold in practice.

Images of accumulation are essential to opening the climate to cultural inquiry and political mobilization. Historically, climatic media in architecture ranged from technical images of thermal comfort and considerations of solar paths to speculative forms of region-specific living. More recently, the manipulation of false color diagrams and their correlate climatic effects are taken as a space of creativity. Similar to the weather, buildings can be experienced, but media is needed to understand architecture: its forms and materials, its relationship to social and geophysical patterns, its changing claims to cultural relevance.

As a site for knowledge production in architecture, climate provides access to a constellation of interconnections between scientific, technological, and bureaucratic innovations, as well as the wide-ranging social transformations to which these fields of practice and inquiry are in relation. Many innovations in materials and design methods that have been fundamental to developments in architecture over the past few decades have also been arguments for a different relationship between social patterns and the uncertainty and unpredictability of environmental conditions. Architecture has been the interface, the media substrate (both representation and material) to recalculate planetary dynamics and infuse them with new trajectories. Architecture, as image and as building, is an essential medium for both constructing and imagining the planet to come.

Posed across this nexus of economies and ecologies, architecture produces a distinct though capacious realm for discourse: a field of technical knowledge that seeks to adjust, reflect, and reconsider—in a word, mediate—the relationship between scientific knowledge of planetary systems and the social means of expressing collective will relative to that knowledge. Architecture works towards new understandings of effective (in the sense of species-continuation) means of engaging ecosystems and behaviors and is part of the cultural milieu that elaborates on, visualizes, and otherwise demonstrates these relationships. It is both a material and symbolic intervention in the lifeworld, simultaneously interpreting it through sophisticated visual technologies and intervening to alter and shape it.

The coming together of climate and architecture reinforces the position of the architect as a mediatic agent and opens the possibility for an analysis of spatial, material, urbanistic, and climate media. Artistic practices, methods of resistance, and literary tropes similarly operate across this nexus of aesthetics, space, and climate. Novel analytic tools that bring together knowledge and practice from a wide range of disciplines are needed. Knowledge and data, images and experiences are the hinge to elaborate on future possibilities, to draw them down to the present, to seed and cultivate their potential.

This mediatic dynamism operates according to the basic principle that the accumulation of carbon in the atmosphere is invisible and that its myriad systemic effects are difficult to trace. The unspectacular nature of images of accumulation stands in contrast to the spatial and increasingly phenomenal experience of the changing climate. Environmental challenges, as Rob Nixon reminds us, are also challenges of representation. In a spectacle-infused culture, it can be difficult to bring into relevance the slow accumulations now destabilizing the climate. In order to visualize accumulation, practitioners are faced with technical challenges not only in image production, but also in conceptualizing new relationships between representation and knowledge, theory and practice, data and agency.

Scholarly discourse has increasingly become attuned to the contours of social and cultural change relative to the unpredictability of the future of the environment. Such discussions have become potent sites for the articulation and elaboration of the media of accumulation and for examining the potential resonance of environmental knowledge across broader social and cultural patterns. As discursive sites, architecture, art, and other creative fields engage in the production of images of accumulation to share knowledge internal to their disciplines and to integrate knowledge across fields, collectively outlining methods for investigating cultural dimensions of the global ecological system.

The discussion of such images and practices is the concern of this book. The essays collected here offer a response to the relative invisibility of the climate seen as material accumulations of social behavior. They outline some of the opportunities and ambitions of visual scholarship as a means to encounter the challenges emergent in the current epoch. How, for instance, can climate become visible,

culturally and politically? Knowledge of climatic instability can impact and inflect collective behaviors. It can offer other trajectories for the accumulation of images, knowledge, materials, and their effects, for counter-accumulations that draw the present into a different future.

The epoch of accumulation has also elicited a new kind of subjectivity. Individual desires and aspirations have transformed in relationship to growing awareness of physiological and climatological changes. Even the concept of the individual is questioned as our daily habits and practices are placed in direct relationship to collective, species-level prospects for a livable future. While the accumulations we collectively struggle against are far from universally produced, pushing against these practices and patterns necessarily invokes a global collective. In other words, the most substantive accumulations are yet to come, as the fates of individuals around the world are inexorably intertwined. We cannot, at this stage, escape the effects of carbon accumulation or the inequities they engender. Yet working together to accumulate knowledge, desire, and aspiration can open thought and practice towards other possible futures.

Nick Axel, Daniel A. Barber, Nikolaus Hirsch, and Anton Vidokle

*Epochal Aesthetics:
Affectual Infrastructures
of the Anthropocene*

Kathryn Yusoff

The Anthropocene renders visible new architectures of time and matter, both sedimenting existing genealogies of global-world-space and radically reorganizing an imagination of the scope and material duration of what the human is in and through time. The idealized architectures of social formations that have hitherto been thought of as purely “social” structures are now beginning to betray their subtended geologies. Unraveling the fantasies of growth without accumulation, the global effects of climate change and resource depletion suggest that there is no accumulation without dispossession in both social or geological worlds. This new vision of the geologic underpinnings of social formations suggests that the “standing stock” of matter was never a suitable means to theorize how the geological and social hook up, or come to matter, nor does it adequately account for the full reach of those geosocial formations into time and sub-surface matter. The ruination of the future, it seems, is as much a product of the subtended infrastructures of architectural projects as it is of these interventions themselves. Or, to put it another way, what was once imagined and imaged as extraneous and external to the rational projects of materializing late modernity might now seem to have found that it had a missing substratum.

The substratum of the technosphere—the output of contemporary enterprise—has a central claim in accounts of the Anthropocene’s material geographies. Waste sites, mining shafts, and extraction zones are imagined as the new museums of humanity, alongside the more affectual and accumulative material registers of pollution, toxicity, and climate shifts. More than the by-products of social projects and industrial practices, such chemical and atmospheric modes of ruination are producing their own unique traces or architectural fossils in the earth such as bleached coral, plasticized rocks, and stored carbon dioxide. The accumulation of new mineralogical arrangements and organic-inorganic composites in the flow of geologic matter provides the evidential base for the Anthropocene.¹ This new intemperate science of fossilization is generating the technofossils of the future.

Everything from the appearance of McDonalds, Dairy Queen, and Walmart chains to changes in nitrogen and carbon cycles position the geologies of the present into interlocking geosocial architectures. We might imagine the term “architecture” to refer to the organization of the material structures of space and its temporal patterning; or, how the material mediation of space orders a specific temporal indexing. This new empiricism of sedimentation, of the rapid destratification and restratification of social, economic, and mineral practices, are rearranging the global dynamics of the bio and geospheres. This suggests that the old artifacts of earth that constituted the imagination of global-world-space are overly

reliant on a stable material foundation and therefore a temporal location. In this sense, as a new rendering of time, subjectivity, and agency, the Anthropocene announces both a break in and consolidation of modernity's temporal arc. The city, as an ever-expanding urban fossil, is enacting a temporal bucking in its allegiance to the "now" in the form of its ongoing contribution to a hominid geology with a duration far in excess of contemporary visions of disposability, newness, and change. The provisional nature of the present and its organization of a form of politics, thought to be a contingent social relation, is being fractured through the temporal break of geology. And, it is through the violent infrastructures of geology that new forms of politics are emerging—such as those at Standing Rock around the struggle against the Dakota Access Pipeline for example—that insist on a different vision of temporal affiliation and material filiation. As Lauren Berlant argues, "An infrastructural analysis helps us see that what we commonly call 'structure' is not what we usually call it, an intractable principle of continuity across time and space, but is really a convergence of force and value in patterns of movement that's only solid when seen from a distance. Objects are always looser than they appear. Objectness is only a semblance, a seeming, a projection effect of interest in a thing we are trying to stabilize."² If infrastructures are also structures of feeling and convergences of force, then the appreciation of those affects need to reach down below the surface into the substratum to see how those forces both maintain and disrupt edifices of intention on the surface.

The underground spaces of extraction and the cavernous holes of excavated fossil fuels are now the curatorial spaces of an anticipatory geology that awaits a future direction beyond human agency. These spaces of extraction are nonetheless tied to the global socioeconomic expulsions of late neoliberal subjective life through the invisible labors of subterranean workers and the toxicities that accompany these material mobilizations. The material destratifications of marine, mineral, and chemical flows of carbon and nitrogen are returning in various accumulative modalities of pollution, toxicity, and anthropogenic climate change, which in turn reconfigure the biopolitical possibilities of life. These affectual material infrastructures are shifting a sense of the planetary by generating new orders of time and a geo-logics of existence, simultaneously hacking and resyncing the planet and its temporal structures to produce an arrangement of the future that looks decidedly irrational and *unthought*: infrastructures of geologic mobility that far outstrip, but are a direct consequence of, conventional forms of material communication and transnational infrastructures, geo-logics of social and material expulsions whose visible effects have been hidden in plain sight all along, understood as the waste

and excess of normative modes of agency, architectural planning, and capital accumulation. The task of geoaesthetics is to think this new duration and material recombinations as a not yet thought affective infrastructure that subtends the architectures of materiality and resource distribution that inscribe the planetary present of global-world-space. Specifically, geoaesthetics might make sensible *how* geologic forces move across time and space to disrupt the provisional unity of global-world-space and render new geographical imaginations of intemperate locations in both political and geologic time. This new form of geopolitics would understand the “geo” as a temporal disfigurement of political space rather than as a descriptive mode of spatiality.

In locating the temporal rupture of Anthropocenic planetary thought, a brief genealogy of global-image-space is required that situates climate change in its geographical imaginations. In the context of this new epoch, geomorphic aesthetics are a space in which ideas and ideals about the affective qualities of this new sensibility are represented not as a depiction of world-space or globality, but as a sensibility that can define the parameters of those organizations of thought or affective infrastructures (and their critique). The geologic and how it comes to matter beyond representational genres as a sensibility of time as well as a quality of materiality is firstly an archeology of the *unthought*; an arena of building and accumulation that has been rendered invisible and contractually mute. In this zone of agitation between matter, what comes to matter and that which has seemingly escaped material memory, aesthetics become a crucial space for engaging with geologic force and time and *its* proposition to stand against the architectures of agency (and reason) that brought the Anthropocene into being.

Fractures in the Architectures of *Global-World-Space*

Every image, every affective architecture that pertains to a global vision and a spatial imaginary, comes from *somewhere*, located in specific geopolitical modes of production and technologies of reproduction. This *somewhere* of feeling that structures perspective and renders orientation is global-world-image-space. It is the persuasion of a globalizing force that encompasses world-image-space from a certain location and within specific locative media. The material, political, and technical geographies of the globe constitute its locative vision within a heterogeneous space of different “worldings,” or meta-ontologies of the world. These meta-ontologies are not just political but also material ordering of the world. This is why global-world-space is world-making in the sensibility of space rather than simply a descriptive act of

spatiality. Global-world-space is the conceit of a global spatiality constructed through uneven geographies of experience and exploitation in order to maintain the privilege of its vision. The Anthropocene is both an addition to and radical departure from these meta-ontologies of the globe.

The development of actual geographic infrastructures that deliver a convincing architecture of global-world-space began in earnest in the early twentieth century, but the origin of the desire for real-time globality and telepresent communications were already evident in the colonial networks of Empire, the telecommunication and transportation networks powered by coal and before coal by slavery. These architectures of globalizing space came to a culmination point with the International Geophysical Year (IGY) of 1957–1958 and the deployment of a line of weather stations that circled the globe, watching meteorological shifts in weather patterns for the telling presence of ballistic missiles. That is, the synoptic accumulation of weather that later became the baseline correlative of climate was initially envisaged as a screen for watching incoming rocketry. Alongside these geopolitical experiments in the vertical architectures of aerial and atmospheric control, Sputnik was launched to provide the first geographical “elsewhere” of territory (after the oceans and Antarctica). The new satellite also launched the geographic imagination of an extraterritorial planetary state of sensing and consolidated the earth as an artifactual sphere of operations. The launch of artificial satellites and landing on the earth’s own satellite (the moon) initiated the beginnings of what Jennifer Gabrys calls a “program earth.” As Gabrys notes, Sputnik “activated a multitude of new experiences for inhabiting the earth,” first as an audio map of a new orbital environment, and then as programmable space.³

Galvanized by the geopolitical context of the prospect of global war, during the Cold War, earth sciences and their sensing technologies became one of the main recipients of funding for new spatial and visual technologies and thus the architects of its vision. Furthermore, “Satellites were promoted as making an easy transition from military research and development to ecological and social applications. Remote sensing developed into a critical technology and method within environmental science and became a crucial way in which to study environmental change on a global scale.”⁴ While the globe appears in the context of the Cold War as the ultimate commodity fetish of the military-industrial complex, how these geographical imaginations of universal spatiality create a homogenizing surface of projection matters in the operationalization of materiality, particularly in how the earth as a global-world-space is viewed as infrastructure of intentional propositions rather than a geography undercut by geological processes.

We should understand the images of globality derived from space and the verticality of vision that aimed for an increasingly spectacular encompassing of the globe—a God’s-eye view—were an attempt to grapple with the indeterminacy of materiality, to banish an atmospheric optic and still the dynamic of the earth. At a technical level, the campaign was against the weather, specifically clouds and their powers to disrupt a clear line of sight. Even before the far side of the moon was photographed in 1959 by the Soviet *Luna 3* probe, the ability to picture the earth became coterminous with the desire to operationalize aerial space, crucial to which was the establishment of accurate weather reporting systems. This involved the strategic positioning of bases at the Poles to detect and measure changes in Cold War atmospheres. Most notably, the US claimed the South Pole and established “Weather Central” at the Antarctic axis. This remote outpost, which formed a terminal link in a pole-to-pole chain of sites running along three meridians, provided a geopolitical encircling of the whole earth and “ground truthed” its global claim. These bipolar measurements attempted to achieve the first synoptic measurements and co-present image of the world’s weather and laid the foundation for climate to be constructed as a globalized space of data exchange. This first global meteorological model of climate circulation served as the baseline data point for anthropogenic climate change and ozone depletion.

Climate change (both long term climate shifts and more recent anthropogenic-induced change) introduced fractures into universalizing architectures and ruptured the neat enclosure of the whole, both in representational and sociopolitical terms. Just as global-world-space is nearly mapped from pole to pole, climate change introduces a shock to the imagination of earth systems as independent from social action. Climate change becomes representative—in the double sense of representing practices and ontological arrangements—of the unintended global (side) effects of these totalizing Western colonial visions of the world and their inability to deal with the material and representative excess of closed world systems. It also demonstrates how world resources have been mobilized for Western growth, while entropy or waste has been exported both into the atmosphere and various colonial and neocolonial sacrifice zones that constitute the dynamics of global-world-space. Excess is not an outside to these visions of global-world-space but a constituent condition of its infrastructures—a condition that is systematically *unthought* through those structures. It is a spatio-affective infrastructure in which certain modes of subjectivization are generated to create constitutive outsides to the privileged subjects of global-world-space, marginal subjects that are differentiated in terms of race and territorial autonomy. It is into this scene of representational failure, in

which climate change models have struggled to compete with the changes already at work in the world (or the various nonlinear and erratic material undoings that can't successfully be modeled into a model, like capitalism), that a "geologic turn" makes its material-temporal intervention.

The claim of an epochal shift in the material and ontological ground of knowledge can also be viewed as a claim for a new epoch of thought. Epochal thought needs to re-materialize, re-ontologize, de-anthropomorphize, and geologize humanity through the specificities of differentiating mineralogical forces. The Anthropocene is both a claim to inhuman life and the recognition of geologic claims on social life. While climate change modelling enacted a transformation of the representative scale of human-environmental relations into atmospheres, ice, and oceans, it did not represent a change *in kind* in the modernist drive towards the totality of global-world-image, imagined as an accumulative strategy of denser and more representative data architectures of the world.

Thinking with the strata or the "geotrauma" of the Anthropocene as an epochal shift *from* sociopolitical *to* geosocial relations is a provocation to think about how the earth stratifies thought, bodies, and disciplines (in ways that the epistemes of Western knowledge cannot entirely take account of).⁵ The inability to comprehend the *unthought* of thought in the infrastructures of global-world-space and its affective residues in relation to the conceptualization of material agency that constitute and actualize reason might seem like a double erasure in social worlds given the embrace of geologic metaphors and materiality that populate some of the most energetic thinking of the twentieth century. Leibniz's and Kant's political philosophy that emerged from the 1755 Lisbon Earthquake; Deleuze and Guattari's plateaus; Foucault's archaeologies and social formations; Freud's unconscious; and more recently, in the realm of feminist materialisms, Elizabeth Grosz's geopower, Elizabeth Povinelli's geontologies, and Angela Last's geopoetics all engage the geophilosophy of a dynamic ground in the making of time, space and ontology.

Geomorphic Aesthetics

The Anthropocene presents geologic time as an inhuman milieu that is both before and after "us"; as both geologic prehistory of the planet whose temporalities now intrude on the present and its social and political forces, and as a future socializing of the strata in humanity's geologic deposits read as fossil traces. But geology is also a force or power that is harnessed, capitalized upon, directed, and let lose in the world, as both fuel and affective materiality of

desire and affiliation—not to mention the filiation of fossil fuels that take social reproduction elsewhere.⁶ Within the grand claims about planetary mastery and the geologic wasting powers of humanity as a concretized lump of geomorphic agency, there is a need to address the material dimensions of a geologically-*informed* subjectivity, or perhaps *a geologically deforming subjectivity* (if we take on board the various destratifying powers enacted on the atmosphere, oceans and strata).

As a concept and material claim, the Anthropocene is not yet an actual object as such (it has not yet been fully approved by the geologic Time Lords of The International Commission on Stratigraphy), but it does name a thought-image of the *thresholding* of geophysical forces (from the Holocene, the stable environmental conditions that have produced our current social and theoretical milieu, to the Anthropocene, which sees the major disruption of the Holocene's planetary biochemical processes), and seems to promise a re-organization of the entanglement between humans and the world at a material and ontological meta-level. If we hold the Anthropocene to its epochal claim of naming a major shift in geosocial relations, the threshold implies the destruction of everything that is tied to the Holocene, including late neoliberal subjectivity and its practices, forms of life tied to and lived through fossil fuels, humanism as an adequate system of thought, and capitalism as the defining plateau of operations.

Conceiving the Anthropocene as a new story of the beginnings and endings of Man recast through geologic timescales, or, a new material and ontological origin story for humanity, is what I call "Anthropogenesis."⁷ It is a story of the fallen master subject with Promethean powers releasing its petrifying hold on the strata of the human species through technological innovation and ecomodernization. It is a genesis that names Man as the originator of a new geologic force operating at the scale of the planet. Geologic change did not begin and will not end with "Man," however, but was born with the vast liberation of energy, first from slavery and then fossil fuels. It matters what origin stories we tell. These mappings of planetary material infrastructures have an affective economy that place some subjects in and some outside of agency. If we acknowledge this energetic subsidy from slavery and mineralogical deposits as having lent not just geologic materials but also *capacities* for force within human life (and who or what gets to count as human within the biopolitics of life), then we can also shift our understanding of the location of agentic power to focus on these human and geologic materials and the capacities that they incite as *the* affective materials of social formations. This is a kind of *ur*architecture or affective infrastructure of social worlds. An ontological reconfiguration might also be considered that thinks the humanist subject as

subtended by and extended in material and temporal reach by geologic materials and its laboring bodies. As such, the Anthropocene represents a new arrangement or geographic imagination of the earth that includes the materiality of contemporary subjectivity, its ecologies, and new discourses on time and history. This new coding of the earth was instigated by both the imagination and actuality of climate change, but the Anthropocene returns us to the earth as *the* territory or *terroir* of differentiation. This claim on and by the earth to be the ground of agentic life is made through an explosion of material effects, including, but in excess of, climate.

Epochal Aesthetics

But what is life like on this New Anthropocenic earth? How is Anthropocenic globalism different from other historic global imaginaries that form a trajectory from colonial to neocolonial to the globalization of capitalism, all with their implicitly unequal and racist geographies? If the Anthropocene is to be a truly epochal moment, surely things ought to *look* different than the dominant Western imagination of human-environmental relations. None of the old stories of Man, Man contemplating Man, Man versus Nature, Man as Nature, Man as Governor/Steward/Modernizer/Innovator/Entrepreneur of Nature, will do. What we need is the imagination of a hundred million Anthropocenes that adequately map the differentiated power geometries of geology and its uneven mobilization through different geosocial formations.

While monumentalizing epochs through golden spikes and the mess of mass extinction events is proper to the discipline of geology, in the humanities there has been a flurry of attempts at preemptively monumentalizing the future event of fossilized humanity. Such acts have often been gendered and culturally exclusive, and confined our vision of the future and its imagination to idealized or heroic future subjects. The monument of the “Geology of Mankind” represents a renewed quest for fundamentals, articulated in the Nature of “Man” and queried through an immortal geologic signature in the strata while simultaneously lamenting the passing of that grandiose Man (if only he could be a better man). He came, he went, he left a fossil (or not) on the geologic beach of time for another idealized man to contemplate. It is the recursive scene of Charlton Heston on the beach contemplating the ruins of Liberty in the *Planet of the Apes*. These interventions that seek to fix the Anthropocene in a singular and monumentalizing event are *fossil-making*—they attempt to make alternative fossil monuments to geology—but do not address the processes and geopolitics of fossilization that are at stake in the *Anthropocene-in-the-making*.

These material interpolations into the geologic substrata produce a new affective scale in both imaginative and material registers that suck notions of agency or intention through a planetary rabbit hole. The problematic concept of “Geologic Life” then, is a problematic of the division of materiality rather than some self-evident continuum of biological (and biopolitical) life for a new epoch.⁸ An acknowledgement of geologic life heralds the epoch of unheroic agency interned in mineralogical exposures and absorptions, discontinuous in its temporal occurrence and at odds with itself as a sovereign being, abandoned in an episode of geologic realism (the mundane reality of continuous extinctions or what Lauren Berlant calls, “Slow Death”).⁹

While the Anthropocene names a break in the understanding of time and geologic epoch (*out of* the Holocene and *into* the Anthropocene), it is also a material cut into bodies: real, actual, specific, vulnerable bodies; bodies of those that do not get to count as fully human in the current biopolitical order; bodies of earth, bodies of nonhuman organisms, social and geologic bodies that *matter*. This precarious mattering is an uneven geography that is mobilized through an affectual infrastructure of geology. In understanding the capture of geologic force there is a need to understand geology as the substratum to human life that pertains to the conditions of survival—something that underpins the possibilities of life and its duration, something like a precondition and possibility of life’s cultural, political, and biological actuality. Accounting for a “geologic life” as the precondition and possibility of life (however categorically organized) links the political geology of extraction to the affective registers of living the good life or late neoliberalism.¹⁰ In this coupling, there is a need to think geologic agency as both formative of political states and an exercise in biopolitical arrangements.

This new field of geopower does not just rearrange an understanding of these two operations and the conceptual foundations they are built upon, but supersedes them as an originary context or precursor to political possibilities.¹¹ Yet this geologic agency is slippery, insofar as it eludes the current structures of accounting for agentic action through the categories of subjective life. It is both above and beyond life. Life is the loose container of geologic affects. Geologic life is the unthought material context of nonlife, whose formations organize some of the structural possibilities for life and its potentials, even as it exercises the impossibility of accounting for those material structures through time as anything more than a fleeting property of the subject. Subjective life and subjective modes become effects of geological compositions that both destabilize and provoke a biological will to power.¹² Thinking with geology as something that passes through and subtends the question of subjectivity, without beginning or ending with the subject, releases modes of subjectivity into domains where agency and

the organization of social structures need to be rethought through explicitly non-normative forms and reconstitutions of geo-political lives. Political revolutions need to undergo and be situated within revolutions of the earth.

Implicit in the Anthropocene thesis is the call to rethink humanity as a new homogenous subjective unit and as a geologic (political) subject. This call that is made in the discipline of geology about geologic time is primarily a re-directional tactic to conceptualize a new material *durée*, which only inadvertently launches a new categorization of human life and its models of a geologic history into being. It is the spatial construction of the Anthropocene as a new mode of globality that releases the temporal implications of geology as an anterior to the present architectures of space and time. If humans have acquired geological force or geopowers, what kind of geologic subjects are borne into this originary moment? What are the identity politics of this scene? How are they shot through with indeterminate, yet determining, forces? Who are the major powers and minor subjects that get to tell their origin stories? If we look at the kind of risks and precarities that are involved between the constraints of territory and the material de-stratifications of climate change, it becomes clear that there are preferred subjects that accompany this epoch into being, subjects that get to author the rocks and others that just get to be ground down by them.

Rather than looking at the futurism of climate apocalypses to come or dwell in the cathartic images of catastrophe, the search might be for a geologic imaginary that disrupts notions of the uninterrupted agency of the liberal subject (and its reins on biologic life) within the ever-increasing accumulations of planetary-scale architectural signatures of the human. Such a notion of geologic life might turn towards the interstitial registers of mineralogical agency and *its* trajectories and modes of stratifications. Examining inhuman and nonhuman excess in the aesthetics of identity formation in the originary scene of the Anthropocene prompts a further question about the role of the nonlocal—or inhuman—in subjectivities and its identifications, determinations, and qualities. How these inhuman qualities of identity—or what I am calling “geologic life”—are negotiated has profound consequences for how human “life” is understood in the context of a broader field of the material and temporal architectures of the Anthropocene *as an epochal event*. More importantly, rendering these affectual infrastructures of geologies past and present must account for the unthought subjects that get caught in its wake. If the Anthropocene’s built environment is not actually about the buildings *per se* but rather resides in the processual material context of all the ruins that surround and anticipate it (human, nonhuman, and inhuman), that construction must be thought of as a process of ruination or the reverse of agency. In

Robert Smithson's terms, architecture is a ruin in reverse, an entropic exercise. And, if the Anthropocene is considered a new epoch of thought, there is a need to think about what an epochal thought should do. Where should it go to account for materiality and temporality differently? How should it define itself against the humanism of the Holocene and its projects and preferred subjects? The capacities that the Anthropocene presently enables in the privilege of making global worlds through thought-images and affective intensities is a geopolitical act.

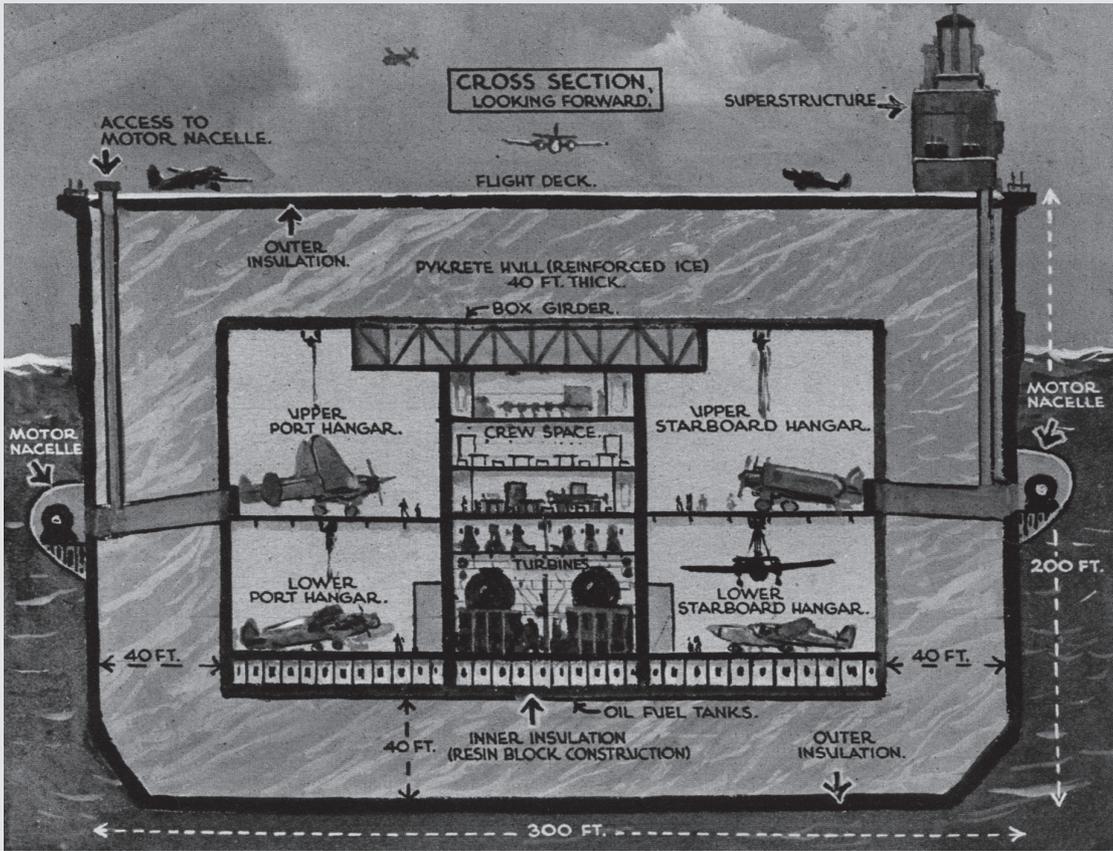
Fascinated by the computational abilities of geology to "sort" geologic materials, minerals, matter, rocks, and soils into strata, Roger Caillois imagined a different kind of "computational planet" than those of scientists interested in earth system management.¹³ But how do social formations and subjective relations, and their event-full and event-less agentic forces, get turned on by rocks? In thinking about the subjective formations of inhuman forces we can begin to understand how minerals arrange subjective modes and geomorphic selves that do not just map into empty space but materialize in bodies and existing racialized and gendered formations of matter. If we are to begin again as geologic subjects in a new epoch, the untimely quality of geomorphic aesthetics might be a good place from which to start to form a new conceptualization of the political geologies and material differentiations of the Anthropocene; one where geologic infrastructures can be shown to affectively undo agency as we know it. Aesthetics can be considered as a mode of experimentation and intervention within the events of the earth—rock life, earth revolutions, geomorphic shifts—and as a space of material communication with the interiority of inhuman forces that experiment with cosmologies of geologic "life" beyond life. In this sense, geoaesthetics is a space of actualization in the formation of subjectivity, but also in the actualizations of the new affectual architectures of geology as a spatial practice that occurs within and between the materiality of bodies as well as the earth. Thus, geoaesthetics are not primarily about picturing or representing what life is within a geological context, confirming its affiliations and forms of self-witnessing, but about experimenting with what life *can or might be* in both its virtual and future anterior modes. Art allows life to surpass itself. By opening a space for the passing of a limit that life itself cannot pass, geoaesthetic acts can resist the biopolitical arrangements that seek to limit and govern particular forms of life through its imaginaries of global-world-space and push further into the earth to locate the undercuts of reason and mine the geopolitics of matter for new imaginaries of geologic life.

- 1 Jennifer Gabrys and Gay Hawkins, ed., *Accumulation: The Material Politics of Plastic* (London: Routledge, 2014).
- 2 Lauren Berlant, "The commons: Infrastructures for troubling times," *Environment and Planning D: Society and Space* 34, no. 3 (2016): 394.
- 3 Jennifer Gabrys, *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet* (Minneapolis: University of Minnesota Press, 2016), 1.
- 4 *Ibid.*, 3.
- 5 Nigel Clark and Kathryn Yusoff, "Geosocial Formations and the Anthropocene," *Theory, Culture & Society* 34, no. 2–3 (2017): 3–23.
- 6 Kathryn Yusoff, "Queer Coal: Genealogies in/of the Blood," *philoSOPHIA* 5, no. 2 (Summer 2015): 203–229.
- 7 Kathryn Yusoff, "Anthropogenesis: Origins and endings in the Anthropocene," *Theory, Culture & Society* 33, no. 2 (April 2015): 3–28.
- 8 See Kathryn Yusoff, "Geologic Life," *Environment and Planning D: Society and Space* 31, no. 5 (2013): 779–795.
- 9 Lauren Berlant, "Slow Death," *Critical Inquiry* 33, no. 4 (Summer 2007): 754–780.
- 10 Elizabeth Povinelli, *Geonotologies: A requiem to late liberalism* (Durham: Duke University Press, 2016); see also Yusoff, "Geologic Life."
- 11 Kathryn Yusoff, Elizabeth Grosz, Nigel Clark, Arun Saldanha, and Catherine Nash, "Geopower: A Panel on Elizabeth Grosz's Chaos, Territory, Art: Deleuze and the Framing of the Earth," *Environment and Planning D: Society and Space*, 30, no. 6 (December 2012): 971–988.
- 12 Elizabeth Grosz, *Time Travels: Feminism, Nature, Power* (Durham: Duke University Press, 2005).
- 13 Roger Caillois, *The Writing of Stones*, trans. Barbara Bray (Charlottesville: University of Virginia Press, 1985). See also Marina Warner, "The Writing of Stones: Roger Caillois's imaginary logic," *Cabinet*, no. 29 (Spring 2008).

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*From Architecture
to Kainotecture*

McKenzie Wark



All the architecture that we know of is architecture of the Holocene. Architecture has had to deal with a lot of unpredictable factors, but the climate of the Holocene has always been an assumed constant. This is the case even with architectures that deal with very unpredictable conditions. For example, Glenn Murcutt has designed structures for the highly variable Australian rainfall. But he could still take a measure of local precipitation, isolate the known peak rainfall, and design a gutter big enough relative to a given area of roof surface for the quantity of water that would most likely land on it. So, while there have been architectures for unpredictable climates, they have been unpredictable within the general form of the Holocene. What does not yet exist is a way of building for a climate that is outside the parameters of the Holocene.

The Anthropocene is, among other things, the end of the Holocene's climate. Globally, temperatures are rising and will not return to Holocene levels in the foreseeable future. We know this from the science of climate modeling, itself the product of an extraordinary global infrastructure.¹ What is rather less certain is what the local effects will be; whether there will be a new relatively stable pattern or a period of prolonged unpredictability. If there is still to be architecture, it will be an architecture without certain givens and constants to ground it.

If all architecture is architecture of the Holocene, then perhaps the Anthropocene is the end of architecture as we know it. The *arche* in architecture means something like origin, source, beginning, command, or conditions of possibility, yet in the Anthropocene one can no longer imagine a practice of building from the same conceptual foundations. Perhaps rather than *arche*, the conceptual root has to be something else, something without that confidence of striving upward.

Perhaps the field of study and practice becomes a kainotecture, from *kainos* (which is also the root of *-cene* in Holocene and Anthropocene), meaning a twist in the quality of time. Perhaps it becomes a xenotecture, from *xenos*, the stranger, who could be friend or enemy. Perhaps it becomes a tyכותecture, from *tyche*, goddess of fortune. Perhaps it becomes a symbebekotecture, from *symbebekos*, the accident. Let's call the overall problem that of a kainotecture, and think of the other *tektions* as what it may turn into when there's more information to go on as to what building will be like in the time the planet is now inhabiting.

The version of architecture's potential future I want to concentrate on is symbebekotecture: building for the accident, and also to some extent, accidental building. It is a ridiculously awkward term for an often ridiculous and awkward set of building practices that have already taken place, yet their accidental and improvised quality make them precursors to any practice of kainotecture. It will

likely be a while before building acquires new constants like those that grounded the various architectures of the Holocene. Perhaps it will never have such constants again, and will remain an improvised solution for an accidental world.

Mentioning the accident and architecture together immediately suggests the work of Paul Virilio, particularly his book *Bunker Archaeology* (1967).² One could think of the bunker as a kind of symbebekotecture: a structure built to withstand the most likely accidents inflicted upon it by attack. For Virilio, improvements in artillery exposed the city and made it impossible to defend by building walls or ramparts. The wartime coast of his childhood Normandy was another matter, however; after the sea and the beach, the bunker was a last line of defense. Topography and built form conspired to keep the Allied forces out.

It might be more interesting, however, to build a preliminary image of our symbebekotecture not from the defensive structures of Normandy, but from those designed and built for the attack. What makes these more pertinent is that unlike the defensive building project of the Nazis, the Allies not only had to build completely novel structures for the landing, but they had to be initially based on complete ignorance of the parameters within which they might successfully work. Thinking from the building of the attack rather than the defense gives us a very different figure for what symbebekotecture might look like, and one quite distinct from the movement-arresting megaliths of Virilio and his collaborator, Claude Parent.³

Let's revisit the symbebekotecture of D-Day through just one figure, who was not in any sense an architect, but might possibly be a prototypical symbebekotect: John Desmond Bernal. D-Day had many symbebekotects, and, indeed, forms of unexpected and serendipitous collaborative labor between them may well be one of the main reasons the invasion succeeded. The story turns on Bernal's deep research about the local variants of a Holocene landscape, and while this is not quite the kind of applied knowledge one needs to build in the Anthropocene, we have practically zero examples of the latter. This little example of symbebekotecture in the Holocene may help us think about how to deal with the unpredictable challenges of building for the Anthropocene.

After studying physics at Cambridge, Bernal gravitated towards the field of X-ray crystallography, where he would first make his mark.⁴ X-ray crystallographers try to work out the structure of crystals. The method at the time was to beam X-rays through a crystal, diffracting the light, on their way to a photographic plate behind. A three-dimensional image of the crystal can thus be deduced from the two-dimensional image. Between the wars, the field was starting to make rapid advances, deciphering the structure of increasingly complex forms including liquid

crystals, metals, wool fibers, and even proteins. It is central to the development of molecular biology, the discovery and production of the “architecture” of pharmaceuticals, and contributed to the discovery of DNA’s helical structure.

Bernal had a very fine, if not absolutely first rate career in X-ray crystallography, which was well under way before World War II. He was not to win the Nobel Prize, perhaps in part because he had rather wide-ranging interests and did not follow a single research line for very long. Some of these interests included his writing of what is probably the first accelerationist tract, *The World, the Flesh and the Devil* (1929).⁵ He also wrote a pioneering Marxist critique of science, *The Social Function of Science* (1939). He was a prime mover in what was known at the time as the Social Relations of Science Movement.⁶ His friends called him Sage.

Like many progressives from his time, he got involved in defending the Spanish Republic from Franco, which in his case involved attempts to mobilize scientific expertise. He tried to be what Foucault called a “specific” intellectual rather than a general one.⁷ He and his comrades conducted scientific tests on the effects of aerial bombardment on urban structures, as well as what poison gas attacks would do to civilian populations, as not much was known about either at the time. This expertise eventually drew Bernal into British civil defense preparations, where he made a modest, yet rigorous contribution to one of the great policy controversies of the war: the effectiveness of aerial bombing campaigns. He devised a method to determine the effectiveness of Allied bombings by studying the Nazi bombing of British cities. Collaborating with a statistician, he did studies on the industrial town of Birmingham and the port of Hull. It was a multi-method study, including questionnaires and essays written by school children, but the main evidence was the statistical relationship between the number of bombs dropped and their effects in loss of life and loss of labor time.

The surprising result of that study was that bombing was very ineffective. Cities, it turns out, are more “resilient” than many had expected. And if British cities were resilient, then German cities probably were too. It was, for its time, a piece of big data research. And it contributed in a small way to high-level decision making as to whether Britain should commit scarce resources to bombing Germany. After the disaster of Dunkirk and the fall of Singapore, Britain had few means of attacking the Nazis. As Clausewitz might have counseled, Churchill took a decision based not only on material factors but morale as well. Thus, Churchill famously decided against the evidence of researchers such as Bernal and committed Britain to an extensive aerial bombardment campaign. Without the air campaign, there would have been no second front against the Nazis, and the Soviet Union alone would have been fighting the real war.

There are already elements here of a symbebekotecture. It's a practice that has to do with space and built form, but in an accidental sense. It's a knowledge of buildings exposed to accidental forces of destruction. In *Terror from the Air*, Peter Sloterdijk argues that modern warfare was no longer about attacking the body of the enemy, but the environment.⁸ Gas and modern explosives are ambient weapons, making a zone uninhabitable for life. They are environmental in a strict, if now somewhat counter-intuitive sense, given that the environment is here an intentional zone of conflict and degradation. What Bernal and his operations colleagues were constructing was knowledge of these affected environments, which could then be redesigned to be less uninhabitable in certain circumstances. For example, Bernal recommended workplace air raid shelters, as it turned out that significant loss of life from bombing came from direct hits on factories. Where bombs fell was random, but where people were more likely to get killed was not.

The style of research Bernal began with his work on the effectiveness of aerial bombardments would turn out to be a symbebekotecture in two senses. Firstly, it addressed an environment of accidental, ambient, and sometimes indirect effects: an exploding world. Secondly, the method itself, while derived from the sciences, was strikingly open-ended. The utility and domain of application of the knowledge he produced was not something that could have been predicted. It took a kind of wide-ranging and creative mind to even figure out what questions to ask or where to look for likely answers. The best example of this was Bernal's involvement in Operation Overlord, as the invasion of Normandy was code-named.

Bernal was a scientific advisor to Lord Mountbatten, who had been put in charge of a group called Combined Operations or CO, an experiment in the command of joint air, sea, and land forces. CO got off to a good start with a successful raid on Bruneval, where a small force managed to capture a German portable radar.⁹ Mountbatten followed this with Operation Jubilee, a disastrous raid on the port of Dieppe, where, as callous as it sounds, Bernal and others learned a lot about how *not* to invade the enemy-held coasts of Europe. The failure of Operation Jubilee fed into the decision with Operation Overlord to avoid an attack on a port, and to land the invasion force on beaches instead. The only real precedent for this was another disaster: the Gallipoli landing in World War I. Bernal was tasked with solving problems raised by trying to get a huge invasion force onto the beaches of Normandy, which, while not as heavily defended as a port, presented enormous obstacles.

Although an early advocate of a beach invasion, the cavalier Mountbatten would not be Overlord's commander. Yet before moving on to the symbebekotecture of Operation Overlord, another of Mountbatten's projects is worth mentioning, despite the fact that

it was never built. Project Habakkuk began with the discovery of a new building material, called Pykecrete, which is basically ice reinforced with wood pulp. Mountbatten asked Bernal to make a feasibility study of building aircraft carriers out of Pykecrete. What drove this plan was the limited range aircraft could fly, the need to harry German submarines (detectable via radar), and a shortage of steel for building conventional aircraft carriers.

As with any new material that lacks a history of engineering experience, building in Pykecrete turned out to be a lot harder than it looked. But besides physical challenges, the Americans and Canadians were never keen, and in the meantime, the invention of external fuel tanks for aircraft and new air bases in Portugal solved the range problem anyway. That said, after the war, the Americans built Drift Station Bravo, a floating weather station on a naturally occurring iceberg, complete with landing strip for light aircraft, but this falls a bit short of proof of concept.¹⁰

Back to Operation Overlord: Would it be possible to land a vast invasion force, including heavy tanks, on the beach? One piece of the solution had to do with creating artificial harbors, known as Mulberry harbors, for which Bernal came up with one of the greatest demos in the history of demos to prove the concept's validity. With a crowd of senior Allied officers around him, he filled a bathtub, then made little paper boats and floated them at one end of the bath. He had an officer make waves at the other end of the bath. The boats sank. He then put a Mae West life-preserver across the middle of the bath and repeated the experiment. The "artificial harbor" dampened the waves and protected the little paper boats. The demo was so successful he was asked to repeat it for Churchill himself.

Bernal was not involved in the design and testing of the Mulberry harbors. Several different prototypes were built and a chance storm provided a valuable test for the designs—itsself a remarkable bit of symbebekotecture. Bernal's focus was on whether tanks would make it up the beach. As chance would have it, Bernal had spent a holiday before the war at Arromanches, the beach code-named "Gold Beach" in Operation Overlord. His first thought was to consult *Le Guide Bleu* for tourists—a basic idea that had not occurred to Naval Intelligence. Both from memory and the *Guide*, Bernal had the notion that there might be a layer of peat laid down during Neolithic times under the sand which might get rather boggy if tanks attempted to track over it.

How can one construct a knowledge of whether the "built form" of a mechanized invasion can happen on a given terrain about which one cannot gather direct evidence? This might be the key point on which one might usefully think of Bernal as a precursor to any possible kainotecture, as this is where he really shone as a symbebekotect. By what experimental accidents could one construct a

knowledge with which to design this mass accident? Bernal did not know whether there was peat beneath the beach. If there was, the whole invasion could bog down in it. So it needed study, but could not be studied directly as the beach was in enemy territory.

Bernal asked a geologist which British beaches were laid on peat and was directed to Brancaster on the Norfolk Coast. Like Hull and Birmingham in the air raid study, it would stand in for its equivalent in enemy territory. Nothing much was known about the interactions of waves on beaches at the time, so he consulted Brigadier Ralph Bagnold, author of *The Physics of Blown Sand and Desert Dunes* (1941).¹¹ From there he extracted ideas for experiments to conduct at the hydraulics lab at Imperial College. So far, inventive but fairly typical operations research steps, but here is where it gets interesting.

Armed with special access to the library of the British Museum, Bernal read through the entire run of the *Proceedings of the Linnean Society of Caen*, beginning in 1840. The Society took summer trips to the Normandy seaside, and Bernal used their accounts of the species they found to determine the likely geological landscapes they would have come from. He found a paper by the Abbé Huc describing the beaches after a storm that confirmed the suspicion of the layer of peat. The Abbé had also received a tour of the local waters by resident fishermen and recorded the names of the local rock outcroppings, whose colorful names suggested the many and particular dangers of these waters.

The *Roman de Rou* is a twelfth-century Norman epic by Master Wace. Upon consulting it, Bernal found that it narrates an escape from a nearby Cherbourg castle along a rocky causeway that appeared only at low tide, on the seaward side of the marshy bog of the beach.¹² Its local topographic name, *Hable de Heurtot*, suggested a harbor, and Bernal's research showed that the causeway had silted up. Going back even further to Roman times, the region's peat supplies appeared in records of local fuel supplies. In short, this might not be ground that tanks could cross without special and rather expensive metal tracks being laid out in advance for them.

Certainty on the matter ultimately depended on the type of sand and the gradient, which could be discovered by commando frogmen sent under cover of darkness to do some surveying, but this risked discovery. The recon operation was tested on the Brancaster beach, with Bernal himself trying to detect the frogmen. After eluding detection, a mission to the Normandy beach was ordered. After their return, Brancaster was found to have comparable grade and sand, so trials could be conducted there to a relative degree of accuracy. These tests showed that tanks could traverse the beach so long as they did not follow in each other's tracks, which would require mines to be cleared on a much wider front. Much to the

consternation of the locals, Brancaster was bombed, as were the Normandy beaches. Aerial photographs of the two were compared.

The Dieppe disaster had shown the importance of detailed photo-reconnaissance. Large stretches of the Normandy coast were photographed at different angles and times of day to create a detailed record without giving away the chosen landing sites. Bernal also sent out a call for holiday pictures taken on French beaches and used them to assess the grade of the beach and local obstacles to tanks. Bernal studied maps of the reefs in detail, going back through the history of mapmaking to the 1776 map by the French Royal hydrologer Beautemps Bernières. As it turned out, over time a lot of little rocks, usually of no interest to anyone but the local fishermen, were left off maps to speed copying.

The launch of Operation Overload depended on the weather. More than one team of meteorologists worked on forecasts. The plan was to launch the attack during a storm that was supposed to end before the invasion force had crossed the channel. This weaponizing of the weather did not quite work out as planned, and strong onshore winds meant that the landing took place on a higher tide than expected. Bernal wanted to go over with the invasion force, but landed some time shortly after, where he was able to see both the success and the terrible costs of all his planning firsthand. He was very unimpressed with the quality of construction of the German defenses that Virilio so admired.

Bernal's work on Operation Overlord might be a symbebektecture in two different ways, then. Firstly, his research aimed at finding a structure for an event that would include a great many accidents. But secondly, the research method itself included many happy accidents, which provided evidence for the development of particular features of the plan in the most unlikely and unexpected places. While this might be a useful example of symbebektecture, it's worth remembering that it took place in the late Holocene. Working on variations in environmental conditions were crucial to the success of Overlord, but they were variations within certain constants, those of a climate stretching back many millennia to the ice ages.

In that sense, it is an instance of a symbebektecture but not yet of kainotecture. These are not the types of accidents likely to confront builders in the temporality the planet is now within. All the same, it might be a sketch for a case study on which to build up a repertoire of case studies so that one might train kainotects for the actual accidents to come. Architecture has managed in one way or another to survive into the era of what Keller Easterling calls "extrastatecraft," and to build things that are a layer of what Benjamin Bratton calls "the stack."¹³ But as both those authors point out, architecture has ended up as a subordinate practice in which physical and material envelopes are really shaped by financial envelopes. Perhaps there's a way for the discipline of architecture to regain ground by rapidly

reconfiguring itself around the contingencies of kainotecture. We could train now for the accidental buildings to come.

It may seem cynical to advocate a kind of territorial conquest for a discipline as a possible advantage to be derived from the Anthropocene, but I don't think anything much is going to be accomplished in the Anthropocene by good intentions, moral appeals, or dispiriting disquisitions on how awful it already is and will continue to be. Rather, it is a time to orient knowledge production around likely future contingencies that give knowledge workers useful capacities that they will need sooner or later, and which are indeed already proving useful now. To be a designer of accidents in a tide of accidents ought not to happen entirely by accident, as it did in the case of Bernal and his coworkers.

The development of the field of kainotecture might begin then with a study of instances when, by chance, some kind of symbebe-kotecture occurred during the Holocene. It may turn out that there are many interesting case studies. From there, kainotecture might advance to something like a tychotecture, a built form that can take its chances in the Anthropocene. But perhaps the goal is really to be able to build a xenotecture. Xenos is the stranger or the alien, but one to which gifts are owed and who might also bestow gifts. This stranger can be both hostile but also play host. Perhaps this stranger is no longer one of us, is no longer human, but is the condition of possibility of any building, indeed of any inhabiting at all. But there is a long way to go before there is anything beyond a futile repetition upon the sinking foundations of architecture.

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- 2 Paul Virilio, *Bunker Archaeology* (New York: Princeton Architectural Press, 2009).
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- 4 On Bernal, I rely heavily on Andrew Brown, *J. D. Bernal: The Sage of Science* (Oxford, Oxford University Press: 2005).
- 5 JD Bernal, *The World, The Flesh and the Devil: An Enquiry into the Future of the Three Enemies of the Rational Soul* (New York and London: Verso, 2018).
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- 10 Geoff Manaugh, "Drift Station Bravo," *BLDGBLOG*, February 25, 2010.
- 11 Ralph Bagnold, *The Physics of Blown Sand and Desert Dunes* (Mineola, NY: Dover, 2005).
- 12 Wace, *The History of the Norman People: Wace's Roman de Rou*, trans. Glyn Burgess, (Woodbridge, UK: Boydell Press, 2004).
- 13 Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (New York and London: Verso Books, 2014); Benjamin Bratton, *The Stack: On Software and Sovereignty* (Cambridge, MA: MIT Press, 2015).

*The Great Transition:
The Arts and Radical
System Change*

T. J. Demos

“The Great Transition: The Arts and Radical System Change” was originally written in 2017, during the rise of and institutional legitimation of Trumpism. Writing now in the year after that administration was thankfully kicked out of office, we’re still dealing with Trumpism’s staying power and the further entrenchment of its ethnonationalist, white supremacist insurgency, coupled with antidemocratic minority rule and continued corporate plutocracy. Extractivism remains a driving force and central paradigm of global capitalism, extending from primary forms of resource mining and fossil fuel drilling to financial, logistical, and cybernetic modes of data mining, surveillance, and mass debt production. The Covid-19 pandemic has further intensified these inequalities and conflicts, displaying the beyond-grotesque corporate appropriation of wealth through vaccine apartheid. Furthermore, decades of neoliberal assaults on public health, economic wellbeing, and social equity have stymied the Western nation state’s capabilities to answer the demands of collective welfare. But the energies of resistance, identified back in 2017, are continuing to grow: #NoDAPL has helped generate the Indigenous liberation movement of The Red Nation; “institutional liberation” has gathered decolonial and abolitionist momentum (particularly in relation to the current Strike MoMA initiative), challenging art institutions’ ties to major corporate asset managers of fossil capital, the military industrial complex, private prisons, and policing; and the ZAD’s autonomous zone in France continues to successfully resist ongoing French assaults on its freedom. While the Biden presidency has ushered in a very different administration re-committed to liberal democracy (and its failures), much of the critical conjuncture brought to the surface by Trumpism continues to inform the present. There remains much work to be done in connecting social movement struggles and drawing on the world-building powers of aesthetic practice. The horizon of a great transition is one that moves beyond the hegemonic conditions of racial and colonial capitalism that is pushing us toward catastrophe.

With the rise of Trumpism, the US finds itself in nothing less than a state of emergency. We face a conflictual and volatile regime of postliberal plutocracy dedicated to extreme wealth accumulation, fueled by patriarchal and white supremacist resentment. With repressive attacks on independent media and civil society activism, the president's administration appears poised to enhance militarized borders and surveillance-equipped counter-insurgency forces to fortify its rule, dividing and conquering via a politics of racist, sexist, and religious scapegoating. Time will tell whether this political formation—one that has been an occasion for critics to revive the term “fascism”—will join analogues in Europe, Asia, and Latin America in defining a global ascendancy of postdemocratic authoritarian capitalism. What we do know is that Trump's nationalist fixation on domestic “development” is thoroughly extractivist—attempting to exploit all available natural and human resources in an effort to maximize profits at a time of grotesque economic inequality, even while he inspires working-class support with his “America First” rhetoric. Indeed, many unions have misguidedly backed his patriotic-defined rush to drill, mine, and build a border wall, constituting a contradictory politics symptomatic of today's dire situation of socioeconomic precarity, according to which we're all led to believe that there is no alternative to sacrificing the earth if we are to have jobs. That agenda, tied to outmoded industries, needless to say, spells disaster for the nation's diverse workforce, as well as its civil society, educational system, media, sciences, and arts and humanities. Though Trump's predecessor was certainly no champion on environmental matters—Obama resisted many environmental regulations and supported an “all-of-the-above energy strategy” that led to the major expansion of oil extraction and pipeline infrastructure in the name of national energy security—the current regime threatens to set us back in incalculable ways.

Adding fuel to the fire, this political shift arrives at a time when we have entered an unprecedented geological interstice, when fossil-fueled climate change has yet to deliver its full impacts owing to the temporal lag between cause and effect. Those transformations—hotter temperatures, drought, rising seas, depleted resources, degraded lands and seas, specie extinctions—accompany and exacerbate social, agricultural, economic, political, and military crises. Not only will they worsen in the next few decades, but adding in the Trump factor, they will also strike with even more violence and intensity. No doubt ours is the era of a great transformation—or what the writer Amitav Ghosh has recently termed, provocatively, “The Great Derangement,” through which we (and future generations) will live, dream, and die with more or less inequality and impoverishment, and thus more or less suffering and injustice, depending on how aggressively we

confront—or continue to ignore—the current crisis.¹ We know that in any case the climate effects will be geographically unevenly distributed, with countries in the Global South, those with the least resources, hardest hit. How will future analysts view this historically unprecedented situation, where our political systems are as out of whack as our ecologies are disturbed? When will we recognize that our current growth-obsessed economic system—cloaked in the myths of freedom and American exceptionalism—provides not the best hope for guaranteeing the continuation of life, but is instead the very cause of the politico-ecological catastrophe we now face? If so, how can culture—as the location where enduring social values, where the narratives, images, and sounds through which we understand ourselves, our relations to each other and to the world we live in are created collectively—contribute to sensing and comprehending the risks and dangers of our present order? More importantly, can it generate livable and desirable alternatives? How can the arts provide new perceptions and affects (for instance, those of justice, responsibility, and mutuality) through which life might be reinvented?

Reassuringly, we're also seeing the growth of major ruptures in the dominant regime, in the US and beyond. This includes the Movement for Black Lives, the massive Women's March on Washington, the spreading Sanctuary cities movement, Indigenous resurgence insisting on land sovereignty and environmental protection, artistic-activist formations contesting petrocaptialist cultural institutions, and the ongoing nationwide General Strikes—each of which refuses to normalize Trumpism, doing so with multiple intersectional solidarities between them. And despite the election, the recent past has witnessed undeniable gains, even if near future pushbacks are already in motion: Indigenous water protectors at Standing Rock temporarily stopped a nearly four-billion-dollar oil pipeline from being constructed on their land in North Dakota and threatening their water sources, while activists associated with #sHellNo in Seattle's port interrupted the oil giant's plans to drill in the Arctic. Meanwhile, the London-based collective Liberate Tate, part of the international Art Not Oil Coalition, won a heroic six-year campaign to get the Tate Galleries to cut sponsorship ties with British Petroleum, and the New York-based group Not An Alternative organized a public petition signed by dozens of renowned scientists urging museums in the US to sever links with fossil fuel corporate sponsorship that led to the removal of billionaire oil heir, right wing philanthropist, and climate-change denier David Koch from the board of New York's American Museum of Natural History. Additionally, radical farmers, climate activists, and artists in western France—building on recent UK-based, anti-fossil fuel occupations such as the Climate Camps—have

been successfully defending their territory known as the ZAD against the state's plans, in cooperation with the French construction corporation Vinci, to develop the area with a new airport, and build in its place a radical experiment in commoning.

These are gains to be celebrated, even though they represent a small sampling of practices with lesser or greater stakes, assorted modes of engagement, and varying degrees of privilege and sacrifice. Yet all are both exemplary of the spread of popular creative uprisings and joyful rebellions and constitute growing resistance to the current political-economic impasse regarding global climate crisis. Measured over the last twenty years of UN climate conferences, we've witnessed nothing less than the complete failure of climate governance to enact policies that would limit emissions to keep the Earth within two degrees Celsius of pre-industrial temperature levels. Indeed, carbon dioxide emissions are over fifty percent higher than in 1992 when the UNFCCC was signed at the Earth Summit in Rio by all UN members who pledged to "prevent dangerous anthropogenic interference with the climate system." Twenty-five years on, we face an insufferable antinomy between the yearly promises to limit global warming and the reality of our movement toward climate chaos.² Unsurprisingly, the ultrawealthy are busy investing in million-dollar escape silos in preparation for the coming apocalypse, apparently not quite believing policymakers who endlessly insist that climate solutions are compatible with continued economic growth. Meanwhile, responsible members of society have demanded radical system change, such as the climate scientist James Hansen, who disparaged the 2015 COP 21 Paris agreement as a "fraud" for its voluntary contributions to emissions reductions, and has, following the recent US election, called for nothing less than a new "revolutionary party."³ With ever greater challenges for our present brought about by the rightward movement of governments toward populist authoritarianism, extreme extractivism, military neoliberalism, and post-political market-based rule, the continuation of petrocapitalism's suicidal trajectory appears to have no end in sight.⁴ Yet the resistance is growing, with calls for insurrection sometimes coming from the most unlikely of sources.

Defending an autonomous zone, blocking an oil pipeline, invading museums: this recent turn towards civil action joins a long history of oppositional culture and anti-colonial politics, creating what some have termed "beautiful trouble."⁵ Its resurgence is not surprising today. When conventional political routes are shut down—whether corrupted by corporate, illegitimate, or antidemocratic influence—we are left is to live according to collectively determined ethico-political convictions, which leads new questions to arise: How might current formations direct their energies in ways that are long-term, sustainable, and transformative, building on the

gains of recent Occupy mobilizations, even while they must operate in an increasingly intolerant political environment? Given the limitations of representational politics, when many demonstrations seem to present the performance of political affects delinked from any appreciable results within the corporate-beholden political process, how can grassroots citizen-led transformation lead to new forms of governance and a transition beyond the current carbon regime including its corrupt politico-economic framework?⁶ More specifically, how might cultural transformation infuse and direct new political organization, bringing militant and insurrectionary actions into relation with coalition-building and electoral politics—the type of relation between the grassroots street and the politician’s policy room that was glimpsed in the Sanders campaign? These are urgent and not easily answered questions, yet they must be asked. Yet, regardless, as in the above instances, creative cultures of resistance and collective practices are being built beyond the terms of the petrocapialist order, and in this era of emergency we would do well to consider their significance and how we might contribute to their growth and expansion.

That said, the divides between gallery-based art practices and the abovementioned cultural formations only seem to be growing, which, given present crises, invites the question: What if these practices—none of which are recognized or self-identified primarily or solely as art—were not simply slotted into the category of activism and dismissed as such by those of us in the cultural sector but viewed, discussed, and taught as the most daring, bold, and courageous expressions of what art might be today? Certainly it would not be the kind of art that is commonly validated in well-resourced art institutions and supported by a generally elite and conservative patronage.⁷ But what if those practices that do garner the greatest visibility in exhibitions and the press—typically dedicated as they are to individualist autonomy, self-expression, duty-free creativity, and visual spectacle—were to be seen as covering over a widespread cultural failure at addressing the most significant world-historical event facing contemporary civilization? What if, in the climate-changed future, those most visible art forms will be precisely the ones that will be indicted for refusing or declining to engage with our contemporary state of emergency?

I’m reminded here of the argument Ghosh puts forward, where he notes a fascinating historical conjunction during the years of colonial and industrial modernity when the Anthropocene emerged at the same time as the establishment of modern fiction. Ghosh notes how fiction, in failing to address climate change, has generally relegated the natural to oblivion. One can also note the larger coincidence of the Anthropocene with Western modernism, premised on similar divisions and hierarchies that have broadly

privileged culture over nature. Aside from a small array of artists, which is nonetheless growing, the engagement with ecology has been largely absent from modernism and its histories. What if this is precisely the problem from the expanded perspective demanded by the Anthropocene? As Ghosh writes: “Indeed, this is perhaps the most important question ever to confront *culture* in the broadest sense—for let us make no mistake: the climate crisis is also a crisis of culture, and thus of the imagination.”⁸

For just as the scientific basis and sheer complexity of climate change appears to force the latter’s cultural address into the genres of nonfiction, so does it assume a seemingly natural relation to documentary modes in the visual arts. Yet both nonfiction and the documentary are equally liable to derision either within the literary institutions of what Ghosh calls “serious fiction” or by those who celebrate gallery-based art that is unmotivated by referential demands and political direction.⁹ But maybe it’s the very organization of culture—including the morbid continuation of these hierarchies that place autonomy and freedom above all else—that’s been thrown out of whack, and is a yet further symptom of the great derangement of which Ghosh speaks. If so, then with the examples of blockadia, Indigenous resurgence, Climate Camps, and institutional liberation pointed towards above, maybe we are witnessing not a failure of the imagination, but rather a structural transformation of the conditions of cultural practice—including a blurring of art, performance, media, theater, and architecture—that is adapting to and critically negotiating the shifting challenges of life at the very moment when the reality of the Anthropocene—or Capitalocene, as some prefer—is sinking in.¹⁰ These formations are materializing and performing ongoing cultural mutations and disjunctions that, though easily misrecognized, rendered illegible, or wrongly dismissed, are enacting the very rupture most needed within our petrocapiatist complex.

Water is Life

The event at Standing Rock represents not only a remarkable Indigenous convergence—building on the Idle No More movement that has energized and networked First Nations across Canada and the Americas in the collective struggle for native rights, treaty enforcement, and self-determination—but also a structural transformation of the conditions of cultural practice. Dedicated to stopping the construction of the Dakota Access Pipeline on sacred burial grounds and under the Missouri River, the camp was set on protecting the water source for tribal members and for millions of people who live downriver from their

campsite.¹¹ All was threatened by the project of the Texas-based Energy Transfer Partners, representing the most visible and recent large-scale investment in the ongoing development of fossil fuel infrastructure and extraction. But this has been more than just a struggle over a pipeline. For Native American environmentalist and writer Winona LaDuke, #NoDAPL represents a “battle for dignity and the future of a nation”—a claim that applies specifically to the Dakota and Lakota peoples (and Native Americans more widely), as well as to us all, for a future of a nation whose character has yet to be determined.¹²

Marked by its prayerful nonviolent resistance to the brutal onslaughts of police and private security acting in the service of corporations, Standing Rock has also gathered an astonishing array of collective, representational, technological, and performative practices of opposition that are not simply reactive to repression but actively define an alternative form of living together based on trust and cooperation. An amazing array of protest graphics and print designs have been unleashed and mobilized in collective protest, and spread virally online, which draw upon the creative resources of Indigenous artists and their allies.¹³ Part of that protest has been the inspiring processes of alliance-building, including the event when US Veterans for Peace movingly sought forgiveness before a group of Sioux elders for the US military’s role in the centuries-long cultural destruction of Indigenous peoples. Videos documenting the camp’s tent encampment, built on a non-monetary economy of mutual care and support, have circulated widely as well, along with diverse photographic imagery of courageous direct actions and front-line confrontations with militarized police. Counter-drones have been launched to contest police technology in surveilling police encampments and documenting instances of brutality. Large-scale mirrors have been deployed that not only shield water protectors, but also reflect the image of aggressive state violence back to the police. These practices of anti-colonial visibility produce critical shifts in perception and dis-identification from state narratives of the conflict. They also promote the knowledge that this conflict, in which the bodies of defensive solidarity assemble against the force of fossil corporate power, is nothing less than the continuation of centuries of Native American resistance to the practices of state-perpetrated genocide adapted now to the extractivist interests of the authoritarian capitalist present.

While each of these acts of collective mobilization and creative mediation are notable, even more noteworthy is the convergence of their visual, audible, and participatory forms that ruptured the order of contemporary state power. In this case, art—designating the formation of an aesthetics of collective resistance and decolonial self-determination—has been integral to the process of not only

cultural survival but also projective world-making. #NoDAPL is not simply a protest over another pipeline; it's a matter of growing a culture that rejects the priorities of everything Trumpism represents, a reality where everything is up for sale. Yet that significance isn't typically recognized because, as Cannupa Hanska Luger, artist and member of the Mandan, Hidatsa, and Arikara Nation, explains "the media's general interest is in 'struggle porn,'" and that "people have missed what is beautiful about [Standing Rock]."¹⁴ What is beautiful about Standing Rock is the cultural resurgence of people who have suffered a still-unfolding history of cultural destruction at the hands of settler colonialism, a conflict that is nothing less than cosmopolitical—an event of collective reality-defining status—in its stakes. The central rallying cry of #NoDAPL "Mni Wiconi," Lakota for "water is life," or "water is alive," did not simply infuse all the activity and death-risking conviction at Standing Rock while the camp was active, but glimpses what botanist and Potawatomi Nation member Robin Kimmerer and philosopher and environmental activist Kathleen Dean Moore claim to be "a story that is so ancient it seems revolutionary." They explain that "[t]he land is sacred, a living breathing entity, for whom we must care, as she cares for us. And so it is possible to love land and water so fiercely you will live in a tent in a North Dakota winter to protect them."¹⁵ That love, that sacredness, that perspective, which views water as life, needless to say, is fundamentally different from the dominant capitalist valuation of oil, and indeed water, as a commodity to be possessed, hoarded, and profited from.¹⁶ The decolonization of water enacted at Standing Rock connects to long histories of Indigenous knowledge and reinvents emancipatory forms of being and ways of relating to one another and to the land.¹⁷

Liberating Institutions

The context and achievements of institutional liberation—perhaps most visible in Liberate Tate's successful six-year campaign—represents a struggle occurring within and around art institutions, as well as public science and natural history museums in the case of Not an Alternative, that is clearly distinct from the frontline Indigenous struggles for cultural survival in violent confrontation with the fossil state-corporate complex. These groups nonetheless express solidarities with Standing Rock, and the movement for institutional liberation is likewise dedicated to a politico-ecological transition to a post-carbon future founded on social justice, the difference being that they start with the emancipation of public cultural and educational institutions from petrocapiatist economics, sponsorship, and propaganda. They expose and target the cultural philanthropy—or

“artwashing”—that grants corporations like BP, Shell, and Total a “social license to pollute,” in the same way that others challenge the “greenwashing” that allows some to manipulate the rhetoric of sustainability to disguise unsustainable practices.¹⁸ Their central question is also how to mobilize collective forms of direct action towards transformative ends, defined by David Graeber as insisting upon acting in an unjust society as if one were already free, according to one’s ethico-political convictions, as if the desired future is *now*.¹⁹ Operating within the cultural centers of Western state power, these groups refuse the politics of representation alone by enacting unauthorized, or rather self-authorized, public performances of resistance to the fossil fuel cultural economy.²⁰ The alliance-building activities of these groups effectively draw together scientists, environmentalists, artists, and diverse publics and point towards the formation of a “collective power” that, according to Jodi Dean, member of Not an Alternative, “mobilize[s] in an emancipatory egalitarian direction, a direction incompatible with the continuation of capitalism and hence a direction necessarily partisan and divisive.”²¹

With divisive partisanship, solidarity becomes a key term, occurring in the socially impoverished context of social media’s info-bubble economy and of renewed attacks on organized labor. Solidarity proposes an embodied sociopolitical relationality of support and mutual care driven by shared political conviction which, even if it is not wholly unified in every way, is markedly distinct from neoliberal social atomization and the mediascape of managed connectivity and enforced separation. While there is an important moment of negation in these activities that draws participants together, there’s also the creation of an emergent shared culture of positive transformation. While groups are resisting museum security and refusing to endorse its narrative, challenging the financial privacy claims of publicly funded institutions and opposing the extraction of cultural value to normalize corporate operations, they are also charging artistic interventions with the energies of social movements, re-infusing institutions with public interest and pushing museums into symbolic sites where the stakes of collective well-being are waged against the narrow interests of financial elites. Not only are cultural private-public sponsorship arrangements suddenly made strange and ethically questionable, but the everyday gestures and unexamined internalizations of such arrangements are consequently made intolerable. Like Standing Rock, this movement preempts the ongoing reproduction of fossil-capitalist culture, decolonizing the future from its capture by short-term profit priorities and expanding zones of ecological sacrifice.

As Liberate Tate has explained, their practice builds on a long history of institutional critique in art—from Michael Asher and Hans Haacke in the 1970s to Fred Wilson and Andrea Fraser more

recently. Current practice signals its difference from that genealogy in explicitly drawing on the power of social movements in order to connect with their “instituent power”: “[A]ctivist-art’s growing popularity marks an entry of social movement strategy into art’s spaces” as well as infuses and draws upon the counter-publics and undercommons beyond and around them.²² As such, institutional liberation goes beyond merely challenging fossil-fuel sponsorship. At its most ambitious, it joins formations like Standing Rock in defying petrocapi-talism and creating “counterpower infrastructure.” As Not an Alternative explains, “institutional liberation isn’t about making institutions better, more inclusive, more participatory. It’s about establishing politicized base camps from which ever more coordinated, elaborate, and effective campaigns against the capitalist state in all its racist, exploitative, extractivist and colonizing dimensions can be carried out.”²³

Blockadia

The ZAD, while no art institution, is precisely such a politicized base camp. With resistance against the construction of an airport at Notre-Dame-des-Landes going back to the 1960s when the French government first announced its plans, the conflict heated up once again following periods of dormancy in 2015 when those who live and farm in the area, some 4000 acres of wetlands, fields, and forests, were put on eviction notice. Since then they have repelled numerous attempts to clear the area by the militarized police, transforming the technical term for large-scale development *zone d’aménagement différé* into a *zone à défendre*. Thousands of participants have since joined the fluid, shifting, and growing movement including farmers, trade unionists, pensioners, radical eco-activists, squatters, engaged activist-artists.²⁴ As the Mauvaise Troupe Collective explain, “the Zad is a space where different ways of inhabiting this world—fully and generously—are invented in the here and now ... It is a hope rooted in histories we hold in common, enriched by the momentum of tens of thousands of rebels and relationships woven thick by time ... like blazing bearings for the future.”²⁵

As an experimental environment, the ZAD contains informal architecture like huts, yurts and caravans, and recycled materials placed in a bricolage of spatial accumulations for inhabitation or blockade. Residents regularly hold “non-markets” where fruit, vegetables, breads, and flour are freely offered or exchanged in barter, organize collective meals prepared to honor guests, and guarantee that everyone has a place to sleep. With its bakeries, tractor repair workshop, brewery, banquet hall, medicinal herb gardens, weekly newspaper, flour mill, library, and lighthouse, the ZAD operates as

an ambitious social experiment in creative and noncapitalist collective living. Zadists publish their own books and texts, create images and videos, and maintain a website and pirate radio station that will soon offer programs in both French and English. Its inclusive, collective decision-making and communal practices contrast starkly with the authoritarian turn in French and European governmental politics, increasingly beholden to xenophobic fears and neoliberal austerity following the crisis over migration and terrorist attacks in recent years. The ZAD figures as a flashpoint in the network of Blockadia, glossed by Naomi Klein as “not a specific location on a map but rather a roving transnational conflict zone that is cropping up with increasing frequency and intensity wherever extractive projects are attempting to dig and drill, whether for open-pit mines, or gas fracking, or tar sands oil pipelines,” or indeed, transport infrastructure.²⁶ Going beyond mere occupation with a short-term goal, Blockadia defines a revolutionary autonomous formation fighting for a society based on principles of direct democracy, gender equality, and environmental sustainability, much like Rojava, the Kurdish radical movement in northern Syria, with which the ZAD expresses solidarity.²⁷ As an attempt to “change everything,” the ZAD camp figures as a “biopolitical assemblage,” a convergence of bodies and signs, technology and media, spatial architectures and social networks.²⁸ Its existence is defined by the daily practice of creative disobedience and the reinvention of the arts of living.

As Martin Legall points out in a recent article on the ZAD, the formation echoes the aims and strategy of the Invisible Committee, the French anarchist collective that advocates the arrest of capital at sites of opportunistic disruption rather than targeting national assemblies and political bodies directly.²⁹ Like the US group Deep Green Resistance, it calls for the formation of underground collectives such as communes, affinity groups, and strike forces to advance anti-capitalist revolution in moments of political, social, and environmental crisis. Indeed, as the Zadists have it,

We call for the spirit of the zad to continue to spread, taking a unique path every time, but with the desire to open cracks everywhere. Cracks in the frenzy of security measures, cracks in the ecological disaster, cracks in the tightening border regimes, cracks in the omnipotent surveillance, cracks in a world that puts everything up for sale.³⁰

The ZAD is therefore far from advocating an exodus or disengagement with the world, but rather connecting directly with social movements beyond itself and mobilizing past potential futures—from the Commune and May ’68 to the Battle in Seattle—as a radical inheritance to inspire the creative reorganization of life now and to come.³¹

The Great Transition

With each new scientific report on the declining conditions of our political, economic, and natural systems, it's becoming clear that the leading question of our time is not simply how to survive and make life livable in a world of capitalist ruins, but how to stop the progression toward ever greater forms of disastrous environmental transformation and limit the impacts of current capitalist plunder while we still have the chance.³² These are the questions that are driving contemporary transformations of cultural practice. Together, they underline the imperative of enacting a radical system change that will interrupt the seemingly inevitable movement toward an increasingly deranged future.

The engagements outlined above, in sum, are not oppositional to art, just as they are surely not collapsible into that category. Instead, they draw on a diversity of artistic approaches in their ambitious redefinition of the limits of what creative world-making can mean today. In this context, aesthetics, emancipated from institutionalized categories and commodification, becomes a way to reorganize the sensible realms of experience, rearranging in turn our perceptions and desires, which carry the capacity to reinvent the material, sociopolitical, and ecological conditions of life itself. All are invested in creative alliance-building and tying artmaking to social movements; all are practicing a concerted unlearning of our relations to water as a commodity, to public institutions as privatized spaces of corporate propaganda, and to community organization as ruled by the narratives of competitive individualism, market logic, and the police. With *Standing Rock*, institutional liberation, and the ZAD, we have the collective construction of images and stories of nature's intrinsic value, of the commons, and of self-determination, initiating a creative break from the current economy of petrocapiatist development. While the Anthropocene does make apparent the necessity of thinking in scales of time and space far beyond the present, and with new ethico-aesthetic imperatives, these movements thwart its neoliberal strands that support geoengineering as the unavoidable technological fix for climate crisis.³³ Entering the breach opened up between our current politico-economic order and alternatives, these creative practices unleash "beautiful trouble" in the sense that it describes, on the one hand, a radical reconfiguration of the otherwise conventional notion of beauty, revaluing it to name creative acts that contest capitalist realism.³⁴ On the other hand, beautiful trouble joins aesthetics to ethics and social justice to climate solutions in producing ruptures from the ruling order, wherein a future of collective ongoingness and liveability is born. The above examples are only the most visible and mediagenic flashpoints of oppositional assembly and

occupation in recent years, but they form part of a rising tide of massive opposition wherein we witness the revolutionary energies called for by figures such as James Hansen.

Grounded in scientific consensus, recognizing the near-future threat of disastrous climate change is undoubtedly the best motivation for a “Great Transition” called for by leading voices within the diverse environmental movement to designate a systemic shift in social, political, and economic life toward a socially just, post-carbon future.³⁵ But that recognition, we know, is contingent upon a complex psychology, including diverse forms of social belonging and other determinants of subjectivity that play powerful roles in the formation of knowledge that can lead to action. To enact a paradigm shift in fundamental values—one that may take generations to accomplish, but that begins with the resources of past struggles as set within the emergency conditions of the present—will take nothing less than the building of entirely different cultures. With these creative ecologies of collective resistance, we experience just that: new combinations of images and stories, music and participation, solidarities and sacrifices, wherein this great transition has already been initiated. Now is the time to push it further and advance it into common sense, so that it can empower diverse allies and would-be participants to transform the world as we know it.

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

2 It’s important to note as well that warming is distributed unevenly around the globe: two degrees for some will be four degrees or more for others.

3 Oliver Milman, “James Hansen, father of climate change awareness, calls Paris talks ‘a fraud,’” *The Guardian*, December 12, 2015.

4 Among recent relevant analyses, see Achille Mbembe, “The Age of Humanism is Ending,” *Mail & Guardian*, December 22, 2016; Alain Badiou, “Reflections on the Recent Election,” *Verso Blog*, November 15, 2016; and see *e-flux journal*, no. 76 (October 2016) on the question of contemporary fascism.

5 For more on the long history and recent examples, see Andrew Boyd and Dave Oswald, ed., *Beautiful Trouble: A Toolbox for Revolution*

(New York: OR Books, 2012); Catherine Flood and Gavin Grindon, ed., *Disobedient Objects* (London: V&A Publishing, 2014).

6 Or as Elizabeth A. Povinelli notes in “What Do White People Want?: Interest, Desire, and Affect in Late Liberalism,” *e-flux conversations*, January 12, 2017, “The global expansion of explosive affect is intensified by the simultaneous expansion of the individual via social media and the tight restriction of the same individual in terms of her imaginary socioeconomic future.”

7 See Andrea Fraser, “L’1%, C’est Moi,” *Texte zur Kunst*, no. 83 (September 2011); Hito Steyerl, “Politics of Art: Contemporary Art and the Transition to Post-Democracy,” *e-flux journal*, no. 21 (December 2010).

8 Ghosh, 9.

9 One limitation of Ghosh’s book is that he doesn’t consider sci-fi—such as the writings of Margaret Atwood, Ursula LeGuin, Octavia Butler, Kim

- Stanley Robinson, and China Miéville—as not only part, but leading examples of “serious fiction.” That said, he’s clearly holding the conventional literary institutions that maintain such genre divisions to account.
- 10 See Jason W. Moore, *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism* (Oakland: PM Press, 2016); T. J. Demos, *Against the Anthropocene: Visual Culture and Environment Today* (Berlin: Sternberg Press, 2017).
 - 11 The pipeline, if completed, would transfer 570,000 barrels of crude oil daily from North Dakota to Illinois, connecting fracking wells from Bakken Shale to refineries in the Midwest.
 - 12 Winona LaDuke, “The Dakota Access Pipeline: What Would Sitting Bull Do?,” *Ecowatch*, August 30, 2016.
 - 13 See, for instance the graphics produced by members of the printmaking collective Just Seeds.
 - 14 Cited in Carolina A. Miranda, “The artist who made protesters’ mirrored shields says the ‘struggle porn’ media miss point of Standing Rock,” *Los Angeles Times*, January 12, 2017.
 - 15 Robin Wall Kimmerer and Kathleen Dean Moore, “The white horse and the humvees—Standing Rock is offering us a choice,” *Nation of Change*, November 7, 2016; for a wider background, see the #StandingRockSyllabus put together by NYC Stands with Standing Rock.
 - 16 Standing Rock, in this regard, enacted the decolonization of water at the very moment of its threatened privatization, and not surprisingly, with Trump’s recent declaration to approve further work on the pipeline, the movement has shifted to an international divestment campaign, to date removing more than \$55 million from the leading financial institutions funding the DAPL construction (in fact Seattle’s Affordable Housing, Neighborhoods and Finance Committee just voted to divest \$3 billion from Wells Fargo, one the project’s leading financiers). Frances Madeson, “Defund DAPL Spreads Across Indian Country as Tribes Divest,” *Yes! Magazine*, February 2, 2017.
 - 17 See Kyle Powys Whyte, “The Dakota Access Pipeline, Environmental Injustice, and U.S. Colonialism,” *Red Ink: An International Journal of Indigenous Literature, Arts, & Humanities* (January/February 2017): “Indeed, the ceremonies at the #NoDAPL camps, expressions such as ‘water is life,’ the sacredness of the Black Hills, the leadership of women, and the many other moral claims about plants, animals, and ecosystems that protectors are making arise from the time-tested knowledges of Dakota and Lakota governance systems that preexist U.S. settlement”; and Nick Estes, “Fighting for Our Lives: #NoDAPL in Historical Context,” *The Red Nation*, September 18, 2016.
 - 18 Mel Evans, *Artwash: Big Oil and the Arts* (Chicago: University of Chicago Press, 2015).
 - 19 David Graeber, “Direct Action, Anarchism, Direct Democracy,” in *Direct Action: An Ethnography* (Oakland: AK Press, 2009), 203.
 - 20 Examples include Liberate Tate’s *Human Cost* (2011), the presentation of a human body soaked in an oil-like substance in a Tate Britain gallery so as to signify the biopolitical costs of petrocapi-talism’s externalities, *Hidden Figures* (2014), the group’s collective gatherings around a giant black square of cloth allegorizing and contesting Tate’s bureaucratic and financial opacity, BP or Not BP’s guerilla theater performance of counter-BP publicity without permission before unsuspecting audiences at London’s Royal Shakespeare Theater and the British Museum, and a coalition of groups including Liberate Tate and Not an Alternative arranging an oil spill intervention at the Louvre to challenge the flagship museum’s sponsorship arrangements with oil multinationals Total and Eni at the time of COP 21’s meeting in Paris.
 - 21 Jodi Dean, “The Anamorphic Politics of Climate Change,” *e-flux journal*, no. 69 (January 2016).
 - 22 Liberate Tate, “Confronting the Institution in Performance: Liberate Tate’s Hidden Figures,” *Performance Research* 20, no. 4 (2015): 83; they cite Stefano Harney & Fred Moten, *The Undercommons: Fugitive Planning & Black Study* (Port Watson: Minor Compositions, 2013) and Michael Warner, *Publics and Counterpublics* (New York: Zone Books, 2002).
 - 23 Not an Alternative, “Institutional Liberation,” *e-flux journal*, no. 77 (November 2016).
 - 24 Martin Legall, “The ZAD: an autonomous zone in the heart of France,” *Roar*, January 26, 2017). On Climate Games, see T.J. Demos, “Playful Protesters Use Art to Draw Attention to Inadequacy of Paris Climate Talks,” *Truthout*, December 13, 2015).
 - 25 Mauvaise Troupe Collective, *Defending the Zad* (Paris: éditions de l’éclat, 2015), 5.
 - 26 Naomi Klein, *This Changes Everything: Capitalism vs. the Climate* (New York: Allen Lane, 2014), 294–95.
 - 27 Mauvaise Troupe Collective, *Defending the Zad*, 20.
 - 28 See Anna Feigenbaum, Fabian Frenzel, and Patrick McCurdy, *Protest Camps* (London: Zed Books, 2013); Yates McKee, *Strike Art: Contemporary Art and the Post-Occupy Condition* (London and New York: Verso, 2016); and Flood and Grindon, *Disobedient Objects*.

- 29 Legall. See also The Invisible Committee, *The Coming Insurrection* (Los Angeles: Semiotext(e), 2009).
- 30 Mauvaise Troupe Collective, 20.
- 31 Thanks to the Otolith Group for the term “past potential futures.”
- 32 Anna Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University Press, 2015).
- 33 See the pro-geoengineering position of Stewart Brand et al., “An Ecomodernist Manifesto” (April 2015), and for a counter-position, Demos, *Against the Anthropocene*.
- 34 Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Ropley, England: Zero Books, 2009); Richard Smith, *Green Capitalism: The God that Failed* (London: College Publications, 2016).
- 35 Paul Raskin, Tariq Banuri, Gilberto Gallopín, Pablo Gutman, Al Hammond, Robert Kates, and Rob Swart, *Great Transition: The Promise and Lure of the Times Ahead* (Boston: Stockholm Environment Institute, 2002); Stephen Spratt, Andrew Simms, Eva Neitzert, and Josh Ryan-Collins, *The Great Transition: A Tale of How It Turned Out Right* (London: New Economics Foundation, 2009).

Hopeful Resilience

Orit Halpern

From the tailings of large open pit mines and omnipresent data centers with their seemingly infinite amount of data to the over-concentration of capital in the hands of the few, we appear to be in an age of dense accumulation, feeling the weight of what once seemed so light. The internet and information has become concrete, literally utilizing the sand and metals of our earth to transmit its data in a manner not so different than constructing roads and buildings. So much weight makes us dream of being plastic and light, mobile, modulatory, capable of bearing all these materialities while continuing to sustain the technical and economic fantasies of eternal growth and novel change. It is perhaps of little surprise then, that since the 1970s, it is the word “resilience” that has become the figure of hope for planners, entrepreneurs, policy makers, and environmentalists alike. Resilience is a system’s ability to absorb shock and continue functioning. The best system is the one that can bear the weight, if we will, of dynamically changing and flexibly responding to the accumulations of population, matter, contaminants, and money. The best ecology is one that can keep operating under a lot of pressure.

The 1970s marked the rise of another myth-reality, that of finance capital and derivatives. Finance is often presumed to be feather light and mobile, unattached to earthly matters. While financial instruments are frequently argued to be detached from the social and material processes that make commodities—understood as money making more money—the recent 2008 “crisis” demonstrated, however, that nothing could be further from the truth. Derivatives are financial instruments that allow a certain amount of something (mortgages, tables, anything) to be traded at some point in the future at an agreed upon price. One can also, for example, bet on the cancellation of an order, or some other event changing the future price of the underlying commodity or security, and so forth. The result is that the size of the derivatives markets far overshadows the actual world’s gross domestic product—the former now exceeds the world’s GDP by twenty times. These markets have grown exponentially, by twenty-five percent per year over the last twenty-five years.¹ Despite being seemingly abstract and delinked from the present, derivatives also drive human actions. People build homes, take out mortgages, and subsequently suffer when these markets move. As cultural theorist Randy Martin has argued, rather than separating itself from social processes of production and reproduction, the derivative actually demonstrates the increased interrelatedness, globalization, and socialization of debt. By tying together disparate actions and objects into a single assembled bundle of reallocated risks to trade, derivatives make us more indebted to each other and to the earth itself, which is often the literal matter of such exchanges. The political and ethical question

thus becomes how we might activate this increased indebtedness in new ways—ones that are less amenable to the strict market logics of neoliberal, perhaps now neo-extractionary, economics.²

What then is the relationship between speculation and resilience? Our contemporary condition, often labeled the Anthropocene, has unveiled the geological materiality of those things considered social and technical—financial instruments, digital media, and information economies—and forced us to ask by what tactics and strategies, by what affective techniques, do we continue to speculate upon earthly destruction? How might we think together the seeming incommensurability of the material weight and geological timeliness of our earthly actions with the speed and mobility of globalized, computational, and machine traded capital?

These questions emerged for me, quite viscerally, in the course of doing field work on the topic of logistics and smart cities. I became concerned with the forms of speculation and hope that continue to facilitate the ongoing penetration of computation—both in terms of “smart” cities, grids, and logistical systems and of finance—into the earth. For architecture, the question becomes one of thinking how time and space are organized to allow for the continuous operation of development and design when there is a widespread recognition that current forms of urban planning, growth, and development are injurious to human and other forms of life. In order to begin confronting the logics of derivation, extraction, and speculation on such negative futures that accept the sacrifice of certain lives as necessary and justified for survival and even growth—what I am labeling “resilient hope”—I want to discuss two scenes from my research: one in West Bengal, India and the other in New York City. While seemingly disparate places, thinking through these sites as related to both financialization and extraction might offer us a better understanding of the forms of hope and speculation currently allowing us to continue myths of economic and technical growth while embracing a future understood as finite and catastrophic.

Disaster Speculation

In March of 2016 I went to West Bengal to investigate urban development in Kolkata and how Chinese capital is reformulating territory.³ One site I visited was the city of Siliguri, located at the border between China, India, Nepal, and Bangladesh on a floodplain of the Himalayas, and therefore an essential component of the vast river systems that are central to life throughout the region. It is also a major site for the extraction of boulders and sand from the river beds that are used for road and building construction, of which there is currently a great deal throughout the region. The

Asian Development Bank has been investing large sums of money to develop a new “silk road” as part of a broader Asian Highway Network to increase and improve infrastructure throughout South and Southeast Asia. Accompanying this speculative infrastructure is a real estate development boom largely catering to foreign investment. Both the road and the condos demand massive financing and, of course, concrete. Concrete, in turn, demands sand particles that are clean, smooth, hard, and without clay, chemical coatings, or other contamination for the mixture. To make concrete one must use sand worn by water, which is usually dredged from a river or seabed. A multitude of often disposable laborers working under deplorable conditions endlessly mine sand from local riverbeds, sinking water levels around Siliguri into the earth, drying up, and threatening a major source of water for much of India and Bangladesh.

Some six hundred kilometers to the south lies Kolkata. One of the largest and densest settlements on the planet, the city was central to the development of capitalism and has long been at the heart of global trade and commerce. Situated between Kolkata’s IT park in Sector V and the airport lies Rajarhat “New Town.” Rajarhat was developed as a space for high-tech corporations and the luxury housing speculatively desired by their workers, but the high-tech industry did not shift its central operations there from other cities such as Bangalore, nor did many foreign corporations open their offices there. With foreign corporations being slow or reluctant to relocate to this zone, what exists in Rajarhat today are secondary service providers to central operations located in Bangalore and elsewhere. Not only did Rajarhat never achieve the designation of “smart city” it was supposed to, but some of the developments are not even hooked into the information and bandwidth infrastructures that are their purported *raison d’être*. While much of the new housing in Rajarhat, not to mention across India, has never been (and might never be) occupied, having been bought solely for speculation by domestic and foreign investors, the construction of luxury condos and office parks continues ahead at full speed. One of the more graphic demonstrations of this disjointed development came on March 31, 2016 when one of the recently built overpasses collapsed, killing many. This collapse was the result of overly rapid construction (which in this case means poor quality concrete), corruption, and the velocity of speculation in the real estate sector.

This rapid speculation emanates from the fact that most of these developments, both the office parks and the residential towers, are heavily leveraged. Long before ground was even broken, both the debt and cost to the state and developers had likely been credit swapped with profits reaped by large investment banks located in the global financial hubs of Mumbai, New York, Frankfurt,

and London. This is a pattern repeated throughout the subcontinent.⁴ While the function of zones such as Rajarhat beyond financialization is unclear, because of the complex and entangled histories of caste, colonialism, and capitalism their development has already cost some thirty thousand people their homes. Since most are from lower castes and never owned the land, previous inhabitants have been easily dispossessed by eminent domain and often with little remuneration. As a result, these people are forced to relocate and occupy the ubiquitous shanty towns of Kolkata, seeking transitory work in locations such as the port where they often supply, under enormous duress, the kind of labor that in other contexts would be automated. Lacking any public health, sanitation infrastructure, or electrical grids, these individuals are literally being worked to death. With their bodies no longer capable of unloading and loading the ships with the efficiency and productivity necessary, dock workers are forced to retire by their late thirties.

Rising Currents

Mirroring these scenes of graphic, territorial-scale violence, are another set of marketing, technological, and logistical endeavors that take part in a positive speculation on precarity and environmental destruction. One of the more astounding recent demonstrations of hopeful speculation focused on the future devastation of New York City. The 2010 “Rising Currents: Projects for New York’s Waterfront” exhibition at New York’s Museum of Modern Art (MoMA) was up until just days before Hurricane Sandy hit the city. One of the most popular projects exhibited was *Oyster-tecture* by the landscape architecture and urban design studio SCAPE, a project that has gone on to be funded to the tune of sixty million dollars. Sited at Brooklyn’s Gowanus Canal, *Oyster-tecture* proposed to grow oyster reefs as ecological barriers. The very practice of using the bodies of humans or of other organisms for and as infrastructure poses historically situated questions about what makes this new mode of managing speculation, populations, and futurity novel—and asked how such forms of speculation are related to the discourse of “resilience?” The irony is that while serving as infrastructure, the oysters would slowly die off as a result of their dirty and inhospitable environments, given rising water acidity and temperatures. This state of being used to death perhaps even goes beyond the terms often invoked to critique neoliberalism such as extraction and subsumption. This death, beautifully rendered by the architects, embraces not only this terminal destruction as aesthetically pleasing, but also the destruction of much of New York by tidal waters, now assumed to be inevitable.

Another project in the same exhibition at MoMA, *New Aqueous City* by nArchitects, repeats this theme of destruction made visible and aesthetically pleasing with a proposal for new zoning plans and the use of literal “bottom up” design strategies, such as placing floatation devices at the bottoms of buildings and sea walls. The video that accompanied their proposal depicted a storm surge and narrated, by way of architectural intervention, the survival of the built environment. As the waters rise, new real estate and agricultural opportunities are made available. When the big storm finally hits, we see individuals calmly gathering on the roof of what appears to be a fancy condominium, prepared for evacuation. As the helicopter swoops down, all is beautiful: the light is gentle, there is no wind or rain. It looks rather pleasant. These images resemble nothing of the devastated environment that Hurricane Katrina wrought on New Orleans, which unlike Sandy, necessitated that people be evacuated by helicopter. In light of such historical referents, one cannot help but wonder who is being left behind.

Resilient Logics

From the recent fetish for making architectural renderings look used, dilapidated, or degrading to reports by groups such as Deutsche Bank claiming the potential risks and rewards for investors due to climate change, there is a new sentiment emerging of casting negative futures with positive affects. My interest is in how to think the automated algorithms (the software, but also the concrete infrastructure of global finance) with its material and physical impact on the earth and on human life. I propose that these images are indoctrinated by what I want to label “resilient hope,” an emergent paradigm that links high-tech computational infrastructures of ubiquitous computing and “smartness,” data centers, and finance, to the more “concrete” extractive or exploitative economies of bodies, such as those in West Bengal or New York City. Brought together, resilience and technology create a form of preemptive infrastructural governance that naturalizes precarity, sacrifice, and violence as necessary economic values, rather than as politically created consequences.

Resilience has a peculiar logic. It is not about a future that is better, but rather about an ecology that can absorb constant shocks while maintaining its functionality and organization. As argued in the work of Bruce Braun and Stephanie Wakefield, resilience is a state of permanent management without ideas of progress, change, or improvement.⁵ The irony is that this hopeless situation is met with hopeful speculation, usually through new forms of temporal management in finance and technology. Thus,

real estate speculation can continue to occur on new silk roads and never-occupied “smart” developments, even as the Himalayan floodplains are destroyed because the end never arrives, but is simply delayed or, more appropriately, derived.

Resilience plays important roles in many different fields, ranging from economics to engineering to forestry.⁶ The understanding of resilience most crucial to this discussion is the one that was first forged in ecology discourses during the 1970s, and especially in the work of C. S. Holling who established a key distinction between “stability” and “resilience.”⁷ Working from a systems perspective and interested in the question of how humans could best manage elements of ecosystems that were of commercial interest (like salmon, wood, and so on), Holling developed the concept of resilience to contest the premise that ecosystems were most healthy when they returned quickly to an equilibrium state after being disturbed. Holling called the return to a state of equilibrium “stability,” but argued that stable systems were often unable to compensate for significant and swift environmental changes. As Holling put it, the “stability view [of ecosystem management] emphasizes the equilibrium, the maintenance of a predictable world, and the harvesting of nature’s excess production with as little fluctuation as possible.”⁸ Yet this very approach assures that “a chance and rare event that previously could be absorbed can trigger a sudden dramatic change and loss of structural integrity of the system.”⁹

Resilience, by contrast, denoted for Holling the capacity of a system *itself* to change in periods of intense external perturbation as a mode of persistence. The concept of resilience enabled a management approach to ecosystems that “would emphasize the need to keep options open, the need to view events in a regional rather than a local context, and the need to emphasize heterogeneity.”¹⁰ Resilience is, in this sense, defined in relationship to crisis and states of exception; that is, it is a virtue when such states are assumed to be either quasi-constant or the most relevant for managerial actions. Holling also underscored that the movement from valuing stability to valuing resilience depended upon an epistemological shift: “Flowing from this would be not the presumption of sufficient knowledge, but the recognition of our ignorance: not the assumption that future events are expected, but that they will be unexpected.”¹¹

Contemporary planning, finance, and design practice abstract the concept of resilience from an ecological systems approach and transform it into an all-purpose epistemology and value. These fields posit resilience as a general strategy for managing uncertainty without an endpoint, while also presuming that our world is so complex that unexpected events are, indeed, the norm. Resilience also functions in the landscape of planning and management to collapse the distinction between *emergence* (which would simply denote

something new) and emergency (which denotes something new that is a threat). In this sense, the term operates in the interest of producing a world where any change can be technically managed and assimilated, while maintaining the ongoing survival of the system even at the cost of the survival of any of its particular components, be they individuals, ecosystems, or species.

Nowhere is this better exemplified than in the aforementioned examples of New York City, where the slogan after the devastation of Hurricane Sandy in 2012 was “Fix and Fortify.” A clearer statement about the stance of urban planners towards geo-ecological trauma could perhaps not be found. Planning, it is posed, must assume and assimilate futures, unknowable shocks, ones that may come in any form, including threats to security, economies, or environments. In the cases discussed, the real destruction of New York was initially taken as an opportunity for innovation, design thinking, and real estate speculation. For the exhibition, the city’s premier architecture and urban design firms were asked to design for a city ravaged by sea-level rise as a result of global warming, about which MoMA’s discourse in the introduction to the exhibition on their website was abundantly positive:

MoMA and P.S.1 Contemporary Art Center joined forces to address one of the most *urgent challenges* facing the nation’s largest city: sea-level rise resulting from global climate change. Though the national debate on infrastructure is currently focused on “shovel-ready” projects that will *stimulate the economy*, we now have an important *opportunity to foster new research and fresh thinking* about the use of New York City’s harbor and coastline. As in past economic recessions, *construction has slowed* dramatically in New York, and much of the city’s *remarkable pool of architectural talent* is available to focus on innovation.¹²

This rather stunning statement turns economic tragedy—the labor crisis in architecture after 2008—and the imagined coming environmental apocalypse into an opportunity for technical, aesthetic, and economic speculation. It is a literal transformation of emergency into emergence: a model for managing perceived and real risks to the population and infrastructure of the territory, not through “solving” the problem, but through absorbing shocks and modulating the way the environment is managed.

Such logics pervade the landscape of large logistical and computational environments. Returning to the initial example of the imagined, never realized, high-bandwidth smart city of Rajarhat, the development of so-called smart cities follows a logic of software development. That is, every present state of the

smart city is understood as a demo or prototype of a future smart city; every operation is understood in terms of testing and updating. As a consequence, there is never a finished product, but rather infinitely replicable, yet always preliminary, versions of these cities around the globe. Engineers openly speak of these cities as “experiments” and as “tests,” admitting that the system did not work, but could be improved in the next instantiation elsewhere in the world. This idea of the infrastructure as “demo” avoids any actual questions of whether this construction impacts the planet, labor, or its inhabitants, and opens the door to assimilate any difficulty or challenge into the next version by way of deferral. This design logic allows the management and negotiation of risks through derivation (from an imagined origin) in a manner that avoids ever having to finally encounter or take responsibility for the impact of respective events—whether weather, economic, or security—on the world. This evasion of encounter with the world happens because the credit has been swapped, or the version already rendered obsolete before anyone can take the time to evaluate the implications of the original bet or question the actual process being deployed. If a prototype “fails,” which is to say is found ecologically or economically suboptimal or nonresilient, then this failure does not provoke a wide scale structural change in approach (for the next development has already been planned), but rather a modulation of current strategy: an assimilation of the adverse event, or any forms of resistance, into the next model while maintaining the basic operations of the ecology or system the same. Derivation and resilience are thus married. The sub-prime mortgage “crisis” of 2008 might serve as exemplar, as from the logic of the derivative there was no crisis, and in fact nothing changed. What is true of finance also often holds true today for urban planning and development.

Resilience and Derivation

The concept of resilience is married with the concept of a future that is always a version, perhaps a derivative replica, of another moment. This is a concept of time in which difference is not historical or progressive, but repetitive in practice while producing constantly differing territories. This is a self-referential difference, only measured or understood in relation to the many other versions of smart cities, all built by the same corporate and national assemblages. Such self-reference in terms of evaluation married to the management and curtailment of temporality into very short intervals mitigates the need to actually find out the “true” value or the actual impacts of a project, an investment, or a bet on the world. As Melinda Cooper has noted in discussing weather futures, contemporary markets

have now produced derivatives that are literally producing value from betting on adverse and unpredictable events in *relation to one another* rather than as discrete occurrences with lived impacts. As she notes,

As a futures methodology, scenario planning is designed to foster decision-making under conditions of uncertainty. Its focus is not risk as such, but rather the radical uncertainty of unknowable contingencies—events for which it is impossible to assign a probability distribution on the basis of past frequencies... In the process, it is the very relationship between the measurable “substance” of the commodity—its stored value—and the event-related nature of price that is reworked: where traditional derivatives contracts traded in the future prices of commodities, financial derivatives trade in futures of futures, turning promise itself into the means and ends of accumulation.¹³

Time here becomes not a relationship to the spatial circulation of goods, labor, and commodities, but a thing-in-itself, a nonhistorical, but also nongeological or nonenvironmental time; it is time as a pure ecology of self-reference. The equation Cooper implies is somewhat new. She argues that if before, at least since the nineteenth century, the futures markets bet on the change in price over time of a commodity (time equals money), then now we bet on time itself. This future is not one that can be predicted, as it does not rely on past data. Financial markets therefore “hedge” bets. Derivatives can be traded and make profits long before we know the results of the investments, and in fact, those who repackage and circulate risks (as with mortgage markets, but now also markets for insurance and weather futures) are betting on agglomerations of dispersed risks and futures, not on the relationship between the “measurable substance” or “stored value” of the commodity and the future price. This provokes new practices, most significantly around measurement, since time no longer equals money but rather money derives from time itself. The form of time here is speculative, not predictive. This logic assumes physical form through engineering and design and the production of test-beds, demos, or prototypes—speculation on a future that is always multiple, and elastic. Perhaps that is why there is a seeming love of animation and re-narration of disaster in all these architectural projects, the constant reminder that change itself is a medium for speculation. If the Cold War was about nuclear testing and simulation as a means to avoid the unthinkable yet nonetheless predictable (nuclear war), then the formula has now changed.¹⁴ This distinction is best summarized in the distinction between risk and uncertainty first laid out in the 1920s

by economist Frank Knight. According to Knight, uncertainty, unlike risk, has no clearly defined endpoints or values; it offers no clear-cut terminal events.¹⁵ What follows is that the test no longer serves as a simulation of life, but rather makes human life itself an experiment for technological futures. This “uncertainty” embeds itself in our technologies of both architecture and finance. Thus, in financial markets we continually “swap,” “derive,” and “leverage” risks that were never fully accounted for in the hope that circulation will defer any need to actually represent or confront it. In infrastructure, engineering, and computing, we do the same. We prototype, develop, and demo, whether in building management systems or creating “smart” infrastructure. We optimize and make resilient environments through a self-referential calculus that compares performance only to the previous version of a building, electrical grid, and so forth. The entire discourse of “smart” cities is invested in evading top down planning in the interest of offering a data-driven system that literally uses its population as resource, medium, and test-bed for new forms of development, extraction, speculation, and life.

As future risk transforms into uncertainty, high technology—particularly “smart” and “ubiquitous” computing infrastructures—becomes both the language *and* practice to imagine our future. Instead of looking for utopian answers to our questions regarding the future, we focus on quantitative and algorithmic methods, on logistics, on how to move things, not on where they end up or on measuring the impacts of these actions. Resilience, now married to infrastructures of ubiquitous computing and logistics, becomes the dominant method for engaging with possible urban collapse (and also the collapse of more *sui generis* infrastructures of transport, energy grids, financial systems, etc.). At the same time, terms like “smartness” become a new catchphrase for an emerging form of technical rationality that, by continuously collecting data in a self-referential manner, is able to constantly defer future results or evaluation and assume the responsibility of managing this structurally uncertain future. What results is the development of forms of financial instrumentation and accounting that no longer (need to) engage with, alienate, or translate extraction from a historical, geological, or biological framework of value.

One of the key (and troubling) consequences of these two operations that now shape and form many logistical territories—the practice of demoing, prototyping, and versioning the imaginary—is that they obscure differences in kinds of catastrophes. While every crisis event—for example, the 2008 sub-prime mortgage collapse or the Tohoku Earthquake of 2011—is different, within the demo-logic that underwrites the production of smart and resilient cities, supply chains, and infrastructures, they appear the same. Differences are subsumed under the general concept of

ongoing crisis without clear event structure. It is precisely this evacuation of differences, in temporalities and societal structures, that is most concerning in confronting the extraordinary rise of ubiquitous computing and high-tech infrastructures—either as solutions to political, social, environmental, and historical problems in urban design and planning or as engines for producing new forms of territory and governance. This logic also prompts us to ask about the possible alternatives: can we narrate alternative histories? Can we produce different environments and designs that create encounters with loss and the ruins of our planet in a manner that allows us to imagine actions *other* than the continued and resilient circulation of capital? What is needed is to fundamentally transform the current practice of deferring negative futures through demoing to another mode. This demands beginning to examine the social movements, construction projects, and many efforts in art, architecture, design, the humanities, science, and politics that have challenged the positive embrace of end times and fought to reintroduce other forms of time and life into space.

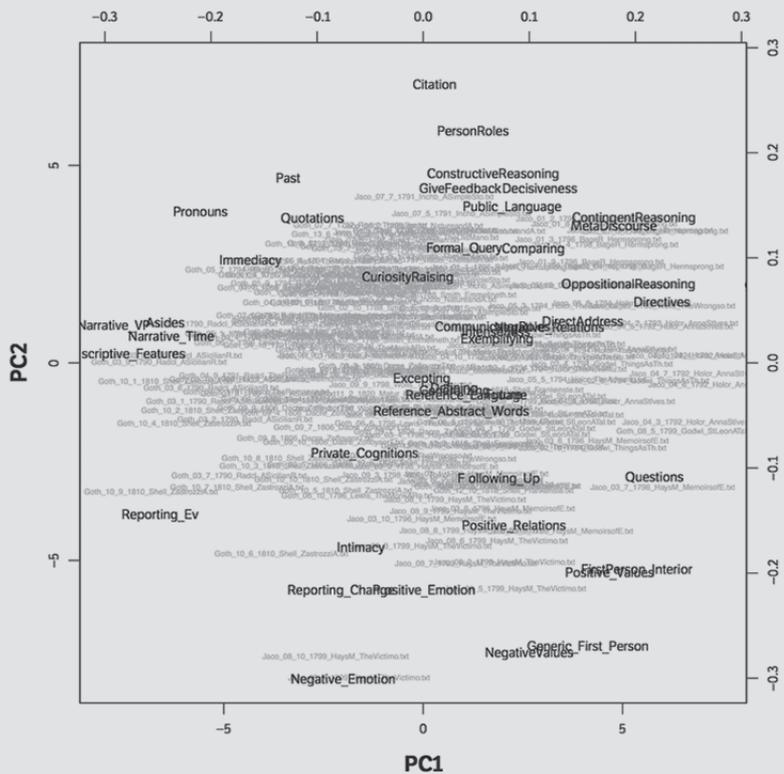
This returns me to the opening scenes of the essay and to contemplate the ethical and political implications of a world where derivation, extraction, and resilience are married in a manner that has turned the planet and all its forms of life into a massive medium for the development of “smart” technologies. When concrete first emerged as an ideal material in modern architecture and in art, it was in the interest of producing another world that was not yet here: utopia. Today, we face a different challenge, one of imagining another world while recognizing the tragedy that already has, and still is occurring to most of life on earth. This demands a change of tense for design and politics. A new imaginary and new tactics for rethinking the forms of futurity we wish to inhabit also demand a different relationship between how we understand financialization, ecology, habitat, and environment. Finance does not replace the social or our connection to the world but could, as many suggest, actually serve as a site by which to recognize how seriously inter-networked and codependent we are, and how the forms of debt to each other and to the planet that we currently all participate in are thoroughly socially produced and contested.¹⁶ Making ourselves indebted in new ways to the many Others that occupy the earth might open to not merely a negative speculation on catastrophic futures, but to forms of care, which are now becoming increasingly imperative. A close examination of finance, environment, and habitat might become the bedrock by which to begin envisioning and creating new futures. We cannot dream of creative destruction, since we have indeed already destroyed the world, but nor can we continue to embrace a world without futures.

- 1 Randy Martin, "What Difference do Derivatives Make? From the Technical to the Political Conjunction", *Culture Unbound* 6 (2014): 189–210, 193.
- 2 Ibid.
- 3 This research trip was conducted as part of the Logistical Worlds research project.
- 4 While actual information about the financing of the Rajarhat development is difficult to find. The data about the lack of occupancy and the probable financing came from discussion with the Kolkata Research Group members Ranabir Samadar and Mithesh Kumar on March 31 and April 1, 2016. Further research on the zone was undertaken by the Transit Labor project, directed by Brett Neilson and Ned Rossiter available on the project's website.
- 5 Bruce Braun and Stephanie Wakefield, "Living Infrastructure, Government, and Destituent Power" (unpublished conference presentation at Infrastructure, Environment and Life in the Anthropocene, Concordia University, October 19–20, 2015).
- 6 Since the nineteenth century, the "modulus of resilience" has served in material sciences as a measure for the capacity of materials such as woods and metals to return to their original shapes after an impact. In other fields, resilience tends to name ways in which ecosystems, individuals, communities, corporations, states, and so on respond to stress, adversity, and rapid change.
- 7 C. S. Holling, "Resilience and Stability of Ecological Systems," *Annual Review of Ecological Systems* 4 (November 1973): 1–23.
- 8 Ibid., 21.
- 9 Ibid.
- 10 Ibid.
- 11 Ibid.
- 12 "Rising Currents: Projects for New York's Waterfront," exhibition introduction, Museum of Modern Art, March 24, 2010.
- 13 Melinda Cooper, "Turbulent Worlds: Financial Markets and Environmental Crisis," *Theory, Culture & Society* 27, no. 2–3 (May 2010): 167–90, 173–78.
- 14 It is important to recognize that there are also alternative histories of temporality and control within computing coming from cybernetics. In the work on organizations and economics from figures such as Herbert Simon, and in the work on neural nets coming from the heritage of Warren McCulloch and Walter Pitts, ideas of "fuzzy" problems and logic were prevalent, and preemption, not prediction, was a dominant theme. These influences went on to be very important and influential in engineering and financial culture, particularly through the figure of Nicholas Negroponte and through architectural collectives such as Archigram and the Metabolists. For more information see: Orit Halpern, "Cybernetic Rationality," *Distinktion: Scandinavian Journal of Social Theory* 15, no. 2 (2014); Judy L. Klein, Paul Erickson, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gordin, *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality* (Chicago: University of Chicago Press, 2013).
- 15 Frank Knight, *Risk, Uncertainty and Profit*, (Boston and New York: Houghton Mifflin Company, 1921).
- 16 Similar arguments in relation to derivatives and credit swapping have been made by David Graeber in *Debt: The First 5000 Years* (New York: Melville Press, 2011) and Randy Martin, "What Difference do Derivatives Make? From the Technical to the Political Conjunction," *Culture Unbound* 6, no. 1 (2014): 189–210, 193.

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Overburden

Emily Apter



Top: Metalanguage model presented by Fredric Jameson in *The Prison-House of Language* (1972). Bottom: Metalanguage model presented by the Stanford Literary Lab in *Quantitative Formalism: an Experiment* (2011).

In taking up the topic here of what I am calling “translational materialism,” my intention is to intervene in a subfield or set of debates emerging at the intersection of epistemology and poetics. In the broadest of terms, translational materialism points to the theoretical and critical challenge of defining what constitutes a “data environment” or field of geomeia as a set of mediate relations between language and matter, with reference to the problematic status of language *as* materiality. More specifically, the term pertains to how the theory and practice of translation is being transformed by research models of data mining, themselves informed on the one hand by corporate monolingualism (the language of business outcome measurement and “best practices”), and on the other by an ecopoiesis that redresses environmentally destructive mining practices such as fracking, clear-cutting, and mountain-topping. Several questions will provide a through line: Is plurilingualism destined to become an example of what the extraction industries sometimes refer to as “overburden”: matter that must be removed in order to extract value? What, in fact, constitutes “matter” in matters of language and translation? How does translation become a source of surplus accumulation, extra, remainder, and waste?

I. Epistemologies of Mining

The mine, as we know, is a time-honored figure for modes of knowledge acquisition, resonating in cliché expressions like “digging for information,” “extracting knowledge,” and “excavating the text.” It crops up frequently in headers for research projects like Stanford University’s “Digging into the Enlightenment: Mapping the Republic of Letters.” As an episteme, mining and its material associations gained traction during the early modern period. From Leibniz in the Harz silver mines to the chemists in the Swedish Bureau of Mines, mining was synonymous with the extraction of knowledge from nature that gradually replaced Paracelsian neoplatonic mysticism with experiment. The frontispiece of Jeremias Drexel’s 1641 *Aurifodina artium et scientiarum omnium excerptendi solertia* (“The Gold Mine,” sometimes given the full title “The Mine of All the Arts and Sciences, or the Habit of Excerpting”) provides a case in point. This seventeenth-century treatise on the art of note-taking traces a trajectory from iron-ore through the humanities and to the pen. In Drexel’s formulation, Katrin Ettenhuber writes: “Books are mines of precious material, and the reader must excavate choice passages through dedicated labor.”¹

A century later, “Section of a Mine,” illustrating Baron d’Holbach’s article “Mine” for the *Encyclopédie*, further draws out the analogy between mining and knowledge production, especially

when placed in the context of the *Encyclopédie*'s "Map of the System of Human Knowledge," which summarizes and orders its entire contents. As Holbach observes, "It is in the earth's depths that nature devotes itself to the formation of mines, and despite this operation being among those most carefully hidden from view, the Naturalists never wavered in their efforts to flush out its secrets."² With its sub-rosa roots, stem, and branches, the image might also be read as a model of the brain. Cast as a terranean and cognitive substructure, it suggests a system of analogical relays among mining and memory, conscious surface and unconscious depth, brain chemistry, and physical nature. Such slippages between conceptual and material associations in the language of mining arguably anticipate the metaphors at work in slogans recently adopted by the extraction industry such as "data is the new oil." What is underscored in this instance is not just the idea that data has displaced oil as the supremely valuable resource, but rather the subterranean or hidden aspect of data which must be extracted and refined, like oil, thus rendering "data mining" the mode of production that best defines "mining" as an epochal episteme.

To gain perspective on the repurposing of mining as an episteme, one must recall Michel Foucault's use of the figure of "archeology," which evokes a discipline heuristically built up from techniques of mining, site excavation, sifted evidence, and the analysis of physical remains, artifacts, civilizational castoffs, and waste products (converted into substances of value). Featured in the subtitle of Foucault's 1966 *Les Mots et les Choses: Une archéologie des sciences humaines* (*The Order of Things: An Archeology of the Human Sciences*) as well as the 1969 *L'Archéologie du savoir* (*The Archeology of Knowledge*), Foucauldian "archeology," some have argued, was an inconsistently delineated figure, yet presumably intentionally so. Julien Laroche, who did a systematic study of the term in Foucault's oeuvre, acknowledges that Foucault himself traced its usage to Kant.³ In response to a critical review of *Les Mots et les Choses* by George Steiner (in which Steiner had faulted Foucault for ignoring the archeological metaphor in Freud), Foucault reminds him that before Freud there was Kant, for whom archeology referred to "the history of what makes certain kinds of thought possible," a paraphrase according to Laroche of Kant's project (much closer to Foucault's than Freud's), for a philosophical history of philosophy, a history written on philosophy's as opposed to history's terms.⁴ Kant, in posing the question of the conditions of possibility of knowledge and possible experience, established the recourse for Foucault's use of the archeological metaphor as a heuristic capable of unsettling the subjection of man to regimes of the absolute concept (universality, necessity, obligation) and the transcendental subject. "Archeology," in early Foucault, thus emerges

as a fluid term for an object of study—“a positive unconscious of knowledge”—consisting of historically uneven yet coincident heterogeneities: rules, concepts, structures. In the forward to the English edition of *The Order of Things*, Foucault avowed:

What I would like to do ... is to reveal a *positive unconscious* of knowledge: a level that eludes the consciousness of the scientist and yet is part of scientific discourse.... Unknown to themselves, the naturalists, economists, and grammarians employed the same rules to define the objects proper to their own study, to form their concepts, to build their theories. It is these rules of formation, which were never formulated in their own right, but are to be found only in widely differing theories, concepts, and objects of study, that I have tried to reveal, by isolating, as their specific locus, a level that I have called, somewhat arbitrarily perhaps, archeological.⁵

As a way of doing history, archeology involves a process of materialist scansion and assemblage that juxtaposes “positivities” and “empiricities” not typically classed together. What is archeologically recovered are myriad surface effects and discursive events, heterotopic spaces mapped relationally by “interstitial blanks.”⁶ As Foucault specifies further in the preface, “archeology” is a stand-in for causality, identified as the “embarrassing” problem of history. In place of causality, with its logic of propositions and explanatory progression, there will be descriptions of “the slow movements of ‘material civilization,’” of “unmoving histories.”⁷ Evidentiary material, like the document, will no longer be treated as “inert material”; instead, it will itself become the site of making and unmaking, a provisional composition of discursive materialities, treated as positivities. Foucault’s strong argument for surface reading is laid out as follows:

Archeology tries to define not the thoughts, representations, images, themes, preoccupations that are concealed or revealed in discourses; but those discourses themselves, those discourses as practices obeying certain rules. It does not treat discourse as *document*, as a sign of something else, as an element that ought to be transparent, but whose unfortunate opacity must often be pierced if one is to reach at last the depth of the essential in the place in which it is held in reserve; it is concerned with discourse in its own volume, as a *monument*. It is not an interpretive discipline: it does not seek another, better-hidden discourse. It refuses to be “allegorical.”⁸

A longer list of what archeology *is* not ensues. It is not a producer of transitional narratives, of progressions or the distillation of *doxa*. It is not an ordering of material in accord “with the sovereign figure of the *oeuvres*,” shoring up the “authority of the creative subject.”⁹ Nor is it a labor of restoration, dedicated to bringing back “in all its purity, the distant, precarious, almost effaced light of the origin.”¹⁰ It is, rather, a critical project aimed at constructing what he calls a “discourse-object” in the guise of a rewriting—something perhaps on the order of what I have previously called a “translation with no original.”¹¹ As a wedge between the initial formulation and the sentence, or between the frequency of an incident and the statistical curve, archeology is that which records the irregularities in regulatory systems and their accepted hierarchies. Its politics, if it could be said to have politics, destabilizes normative structures by revealing, “at the root” (the expression is Foucault’s in relation to what he calls “the tree of derivation of a discourse”) those “governing statements” that define “observable structures and the field of possible objects.”¹² Archeology comes into focus as a critical operation performed on history-making rather than as a process of excavation akin to mining. If there is a kind of mining figure to be distilled, it is associated with translation: the translation of “object-discourses” into modes of spatial articulations located outside axiomatic deductions, rational orders, “systematicities,” and “chronological successions,” which is to say, within, as Foucault puts it, an “enunciative homogeneity that has its own temporal articulations.”¹³

Foucault’s “archeology of knowledge” carefully eschews analogies between mining and knowledge extraction, leaving us with a translation problem; one that involves transcoding “the positive unconscious of knowledge” into a metalanguage that embraces contradictions and spaces of dissension. “In relation to a history of ideas that attempts to melt contradictions in the semi-nocturnal unity of an overall figure or which attempts to transmute them into a general, abstract, uniform principle of interpretation or explanation, archeology describes the different *spaces of dissension*.”¹⁴ Somewhat paradoxically, for Foucault, it would seem, the excavation of material surfaces is brought out to disturb the surface of contemporaneity by exposing an unconscious of history, an unconscious that, instead of being buried deep below the surface of the conscious mind, is simply surface-mined, if you will. What results is a making-manifest of composite positivities that disbar hermeneutics or any act of interpretation from the standpoint of sovereign exteriority and an above-ground perspective.

If I have made a fairly extended detour into Foucault, then it is to underscore how, in his critical matrix, the language of knowledge mining and archeological excavation yields to metaphors of surface that dissolve the object of knowledge in a field of materialities that

are intermedially translated. This translational materialism moves between and mixes phenomenal and linguistic orders: physical traces, remnants of material culture, historical documents, and discursive structures of description and epistemology.

Fredric Jameson's 1972 classic *The Prison-House of Language: A Critical Account of Structuralism and Russian Formalism like Foucault's Archeology of Knowledge*, complicates how we understand the material status of heuristic metaphors, from archeological to carceral ones. Whereas in Foucault we are still in the framework of "digging below the surface" to uncover data or knowledge, in Jameson's work, the discursive metaphor of language as such is modeled as a material structure: a prison wall to be traversed, an architectural institution building—the "prison-house" that incites breakout.

While Jameson's appropriation of the "prison-house" metaphor from Nietzsche's late notebooks, often included in editions of *The Will to Power*, looks to have been at best an overreading, and at worst a mistranslation of Nietzsche's turn of phrase "*sprachlichen Zwänge*," which is usually rendered simply as "constraints of language," his use of the metaphor still allows us to transition from an archeology of knowledge to an ecology of language that provides the terms for thinking through ecologies of big data. Jameson treats structuralism's "linguistic model" as, at once, the material ground of literary linguistic systems and as a metaphor for the *epistémè*, the so-called "structure" in Structuralism:

Nothing could be more fitting, one would think, than the application of linguistic methods to literature, itself essentially a linguistic structure. Yet the older stylistics, that of Spitzer and Auerbach, or more recently of J.-P. Richard, worked much more closely with the verbal texture of the work itself. We find ourselves ultimately before the conclusion that the attempt to see the literary work as a linguistic system is in reality the application of a *metaphor*.¹⁵

Here, Jameson attempts to retrieve the "verbal texture" of a work—its textile/tactile materialities—rescuing it, as it were, from the abstracted economy of "linguistic structure" and anticipating materialist approaches to "media genealogy" of the kind one discerns in Bernhard Siegert's *Cultural Techniques* (2015).¹⁶ While Jameson does not directly deal with the impact of research technology on the humanities in *The Prison-House of Language*, with Thomas Kuhn's "structure of scientific revolutions" clearly in mind, he presciently heralds the computer as the next great paradigm-shifter. He opens Prison-House with an apodictic pronouncement:

The history of thought is the history of its models. Classical mechanics, the organism, natural selection, the atomic nucleus or electronic field, the computer: such are some of the objects or systems which, first used to organize our understanding of the natural world, have then been called upon to illuminate human reality.

For Jameson, the model is something that “lives” with a certain life cycle. In its early years, it achieves stability “serving as a medium through which a new view of the universe may be obtained and catalogued.” Later, however, the model starts to decline and,

a proportionately greater amount of time has to be spent in readjusting the model itself, in bringing it back into line with its object of study. Now research tends to become theoretical rather than practical, and to turn back upon its own presuppositions (the structure of the model itself), finding itself vexed by the false problems and dilemmas into which the inadequacy of the model seems increasingly to lead it. One thinks, for example, of the ether or of collective consciousness.¹⁷

The model of structural linguistics served as a medium through which a new view of the literary universe was obtained and catalogued. Its historical sweep through other disciplines and usurpation of the place of philology and stylistics in literary theory brings us back to that earlier cited passage in which Jameson hones in on the “metaphoricity” of the linguistic paradigm in structuralist theory and literary criticism. Jameson’s attunement to the material status of epistemic metaphors and heuristics serves as a prompt to pay comparable attention to mining metaphors in contemporary parlance. To what extent then is the language of data mining, with its glossaries borrowed from the extractive industries, metaphorical? To what extent have “data” or “mining,” or the two words brought together, come to occupy the same position that “language” did at the height of the linguistic turn? Is “data mining” itself the language that the digital humanities speaks, and if so, what is its relation to algorithmic code (continuous with, parasitic on, mimetic of)? How does code inscribe a numerological unconscious, or monolingual drive within the language of research?

Any attempt to answer these questions on my part will not entail evaluating technologies of machine translation, which is well beyond my competence. Nor will I pretend to take stock of how machine translation is changing the cultural and political landscape of translation, either with respect to written documents (especially in the fields of international law and human rights) or oral communication in real time and real-life situations, in warzones, tourism, and

web-based finance capitalism. Instead, following Jameson's analysis of the "linguistic model" in the era of Structuralism, I will focus on "data mining" as the premier model of the moment, approaching it first as a technology that enables plurilingual research, second as a praxis that reinforces the drive to monolingualism in the humanities (with particular consequences for comparative literature and the teaching of world languages and literatures), and third as a kind of invisible translation, a translation on the surface of language—hiding, as it were, in plain sight, yet curiously unremarked as such. I am thinking specifically here about the way "data mining" translates or remediates the language of materialist ecology and business-based "best practices" without ever being recognized as translation. Mario Carpo makes a relevant observation about the expression "Big Data": "*Big Data* is a cultural trope more than a technical term. Yet the expression originally referred simply to our technical capacity to collect, store, and process increasing amounts of data at decreasing costs, and this original meaning still stands, regardless of hype, media improprieties, or semasiological confusion."¹⁷ Carpo presses on the ambiguous relation of a cultural trope to a technical term. Following suit, I want to press on the ambiguous relation of a trope of materialism—industrial ecology—to lexical research and translation theory.

In an era of digital humanities, contemporary translation aspires to all-over, maximal worlds of translation: graphic adventures in transmedial or hypertextual translation, unfinished philological symphonies, or spinoffs of textual *génétique* where, instead of arriving at the "final version," the published or officially disseminated text becomes a panoply of *variantes* that reach no terminus, approximating instead the continuously self-differentiating process-work tasked with a non-totalizable project. Prismatic translation, in these terms, reconciles *translatio* with Big Data, with data mining programs built up from lexical search engines that allow for comparisons among past translations, mistranslations, and hypothetical translations. It implies a kind of "possible worlds" theory of translation that, by technically "showing the math" of translational decisionism, allows us to "think in translation" and "see" the process philosophy of the verb "to translate." One could object that this prismatic retains something prison-like because it submits data users to the infrastructural colossus of exponentiated research software and the epistemological absolutism of *logiciel*, but that would be the subject of a different, and much longer meditation.

Translational data, treated as nondelimited corpora organized around keywords and textual variants, lends itself to data analytics and experiments with the graphics of hermeneutic modeling. Take, for instance, what a model of metalanguage looked like in 1972, in Jameson's *Prison-House of Language*, and compare it

to what its data-mined counterpart looks like in two images from Sarah Allison, Ryan Heuser, Matthew Jockers, Franco Moretti, and Michael Witmore's first *Pamphlet* from the Stanford *Literary Lab*, which used the computer program "Docuscope" to test "whether computer-generated algorithms could 'recognize' literary genres."¹⁹ In his own contribution in the sixth *Pamphlet*, Moretti replaces the hermeneutics of reading with the "operationalization" of literary information, naming it the "hero" of a grandiose research enterprise, "a bridge from concepts to measurement and then to the world." Characters, in this system, turn into calculable units that form datasets that may be instrumentalized in literary research, transforming, for Moretti, the substance and stakes of literary theory. In the process, there is a surreptitious transfer of properties, whereby a general metaphor of computational instrumental reason is transubstantiated, thereby turning literary character into pure instrument, an incarnation of utensility:

The protagonist is a utensil; character-space, is an instrument. The protagonist is a utensil because it belongs to the world of readerly common sense, and doesn't go beyond it. Character-space is an instrument, because it's the realization of a theory that wants to understand something "that does not fall under the domain of our senses": instead of individual characters, the relations among characters. That's why, in the end, its operationalization produced more than the refinement of already-existing knowledge: not the protagonist, improved, but an altogether new set of categories. Measurement as a challenge to literary theory, one could say, echoing a famous essay by Hans Robert Jauss. This is not what I expected from the encounter of computation and criticism; I assumed, like so many others, that the new approach would change the history, rather than the theory of literature; and, ultimately, that may still be the case. But as the logic of research has brought us face to face with conceptual issues, they should openly become the task of the day, countering the pervasive clichés on the simple-minded positivism of digital humanities. Computation has theoretical consequences—possibly, more than any other field of literary study. The time has come, to make them explicit.²⁰

Moretti's application of data mining to narrative units within literary history has tended to produce interesting "atlases" of genre and canon evolution, but delivers far less satisfactorily on textual analysis. Another model of "critical digital" is Peter de Bolla's *The Architecture of Concepts: The Historical Formation of Human Rights* (2013) which activates cross-Channel (mis)translations of

“right” and *droit* in its exposition of political theory, bringing out differences and areas of the untranslatable in constructs like “rights of man” and “human rights.” The book experiments with combining traditional philology and digital methodology. As Christopher Prendergast notes, the positive gains in scalar knowledge are incontestable: “Scanning short to very long sequences of text embedded in a huge corpus of digitized textual material, this is a form of inquiry which moves on from the history of concepts as a history of ‘meanings’ based on dictionary definitions, to the fleshing out of ‘environments’ in which the formation, structure and function of concepts ... are mapped in terms of ‘neighborhood’ relations on a hitherto unimaginable scale.”²¹

II. Overburden

Before waxing too euphoric about what data-mined research across languages can do, let us note that this plurilingual method is fundamentally contravened by the lingua franca of data mining itself, called out by Barbara Cassin as “Globish”: a standardized, impoverished form of English that undermines the entropic freedom of “philosophizing in languages” and revalidates linguistic universalism and univocity by virtue of its default to algorithmic code. Globish and code fall under what Johanna Drucker, in her influential essay “Humanistic Theory and Digital Scholarship,” dubs “technological restraints”: “Humanities content met digital methods and created projects in which the terms of production were, necessarily, set by technological restraints.”²² These constraints apply not just to research objects bounded by technics, but also to epistemes governed by outcome-driven analytics and trash disposal systems. By way of example, consider a schemata for data mining languages in which the unit “Lexicon” is merged with the unit “Information Preprocessing” and reunited as “HTML parsing, Tokenization, Stemming” and “Higher-level Knowledge,” and then moved into a global “Database” that dumps it into bins bearing a distinct resemblance to trash-bins.

In deferring to streamlined forms of English—from Business or Basic English to internet-inflected forms of Globish—data mining promulgates a presumptive stance *against* translation. Plurilingualism is de facto taken off the table because its utility is minimal or task-specific in limited ways. The logic of cultural understanding, often invoked to support translational pedagogies, can easily be dismissed as fuzzy or uncongenial to transcoding or other communication technologies. A second, related problem is that with the adoption of digital methods of research, one sees the mission creep of organization and management into the heuristics

of a value-added humanities education, with consequences for what kinds of research get funded or receive broad institutional support. Check any glossary of data mining or digital research on a corporate website, and one immediately discerns that the basic terms are impossible to disintricate from normative standards of optimization and customer service. One might note that, in particular, “binning” referring to the process of breaking up continuous values into bins that performs a service to processing. Or “Brute Force Algorithm,” a computationally cheap though inefficient way of achieving value-added results. It is difficult to determine how much of this language is referentially material and how much is metaphor for an economy of optimal production and managed waste. All of which, I would say, contributes to the commercialization of knowledge projects, to the drift towards the formal requisites and use values of product, which leads back to the problem that I began with: the complex and still, relatively underexamined relationship between the language of mining and the extractive industries (oil, gas, minerals).

Mining, as was previously underscored, is an old epistemic figure associated with exploratory research, subterranean metaphors of interpretation, and modes of symptomatic reading, evident in expressions like “digging beneath the surface,” “dredging up what’s hidden below,” “mining” the text for meaning, “extracting” what is important, translating from an originary “source” into a target. But when coupled with the word “data,” mining inches closer to industrial referents, to things like “data refineries” which, when diagrammed, become part of what Jennifer Wenzel has called an “extractive aesthetic” (a design or poesis of product, an abstract representation of processes for transforming waste or base material).²³ It is surely no random coincidence that the diagram of a data refinery exhibits a formal resemblance to a petroleum refinery! Implicit here is a certain commensurability between knowledge computation and environmentally destructive practices: specifically the removal of material—rock, topsoil—that stands in the way of minable resources (ore, coal, petroleum). The industry term for this is “overburden.” While it technically and more narrowly refers to non-toxic byproducts—earth stockpiles that can be recycled to repair an exhausted site, as opposed to “tailings” which contain lethal contaminants and are non-reusable—overburden can be extended to a more general usage in reference to mining and extraction, and specifically to practices of clear-cutting, mountain-topping, fracking, and river-dredging. The lexicon of overburden represents a fascinating mode of translation, one that shuttles between material referents that index damaging environmental practices and metaphors for models of data management. Salient examples include: “data dredging” (referring to data sets deemed

too small to draw valid statistical inferences from); “data fracking,” (the use of hidden measures to extract data); “drilling down,” (associated with foraging “deep” within information systems in order to make determinations of sales impacts, customer satisfaction, and corporate profit); “data exhaust” (designating information byproducts, i.e. storable choices, actions, and preferences often repackaged and resold); and the glosseme “CART” (“Classification and Regression Trees,” defined as a “type of decision tree algorithm that automates the pruning process through cross validation and other techniques”). CART illustrates the normative wobble between anodyne senses of “pruning” (a favored figure of speech for textual editing) and clearcutting, a method of logging that strips out topsoil, contributing to deforestation and climate change.

Such slippages take us back to the ecopolitical metalanguage found in Jameson’s *Prison-House of Language* where he describes the Structuralist project of decoding and decipherment as “geological upheaval.” Jameson borrows the metaphor from Claude Lévi-Strauss, who, in *Tristes Tropiques*, interpreted the “arid soil” and “millenary stagnation” in his native Languedoc region as both brute material sign and “*maître-sens*” of structuralist decoding. Interpreted as “surface translation”—a translation of what is lying on the surface but which is neither being perceived nor understood—the lexicon of data mining discloses potential damage wreaked by the unsafe disposal of overburden.

We might, through this lens, think of whole areas of vital research and critical inquiry—languages, the humanities as such—becoming classifiable as “overburden.” This is of course an over-reading of the term, but what I want to underscore is that the digital languages that Information Research Technology speak are based on the abstraction of extraction, itself grounded in a language of branding and digital communications, a “patois of managementese,” to borrow Keller Easterling’s apt description.²⁴ Data mining, considered as a language that commingles ecologies of resource harvesting and the abstract computational modeling of data “environments” takes us beyond the limit/constraint (*Zwang*) of a critique of corporate monolingualism and towards the problem of “translating” materialities in digital ecology. How does one translate “overburden” as humanities waste, identified, as Wenzel implies, either as toxic residue (“perfectly good stuff that just happens to be in the way”) or “a way of understanding the costs of a resource logic taken to its furthest conclusion?”²⁵ One might repurpose “overburden” as a concept-metaphor of the moment, broadly referring to the effects of the industrialization of linguistic product in the era of digital technology, as well as to the materialities of language that are economized as disposable, yet which nonetheless persist as leftover material, defying operationalized subsumption.

Here is where the politics of ecopoiesis comes in. By way of conclusion, I will consider a poem titled “Bulldozer” delivered in Perth, Australia by the Australian writer John Kinsella. A video of Kinsella reading the poem situates the text at a protest action organized against the Perth-Freight Link, which is designed to take trucks via a toll road to the Fremantle Inner Harbor. The road will cut a damaging swath through the Beeliar wetlands (among the last in the South Metropolitan region) and Banksia woodlands, both considered ecological stepping stones for multiple rare species. Moreover, diesel pollution generated by the trucks is known to have damaging health consequences that include an increase in cancer, asthma, and other respiratory diseases. Kinsella and fellow protesters set up camp on the Roe 8 highway site in Perth.

Bulldozers rend flesh. Bulldozers make devils
of good people. Bulldozers are compelled to do
as they are told. Bulldozers grimace when they

tear the earth’s skin—from earth they came.
Bulldozers are made by people who *also* want new
mobile phones to play games on, *and* to feed families.

Bulldozers are observers of phenomena—decisions
are taken out of their hands. They are full of perceptions.
They will hear our pleas and struggle against their masters.

Bulldozers slice & dice, bulldozers tenderise, bulldozers
reshape the sandpit, make *grrriing* noises, kids’ motorskills.
Bulldozers slice the snake in half so it chases its own tail,

writing in front of its face. Bulldozers are vigorous
percussionists, sounding the snap and boom of hollows
caving in, feathers of the cockatoos a whisper in the roar.

Bulldozers deny the existence of Aether, though they know
deep down in their pistons, deep in their levers, that all
is spheres and heavens and voices of ancestors worry

at their peace. Bulldozers recognise final causes,
and embrace
outcomes that put them out of work. There’s always more
scrub to delete, surely... surely? O *continuous tracked tractor*,

O S and U blades, each to his orders, his skillset. Communal
as D9 Dozers (whose buckets uplift to asteroids waiting
to be quarried). O bulldozer! your history! O those Holt tractors

endowed with preternatural powers of perception and equipped with aesthetic capabilities as “percussionists,” music-makers of destructive soundtracks. Like data mining programs these bulldozers are driven by economies of outcome. They execute programmatic commands like “scrub and delete,” a banal expression that here takes on sinister valences as a wordplay on scrubbing brush from the landscape or deleting the verdant refuge (“Green is your irritant”). When Kinsella lambastes the bulldozer, calling it out by name in a series of apostrophic imprecations—“O Cummings and Caterpillar,” “O great *Cat*”—we have a kind of translation of the thing—the engine of overburden—into a figure of ecopoiesis. In this instance the bulldozer, cast as a tool of resource extraction, is repossessed as a metaphor of resistance against its own processes of destruction. It scorches the earth, a process encapsulated in the phrase “Excoriating the eco-system,” but this “excoriation” is a resource word, recuperable as a talisman or countervailing force to defoliation. It becomes a way of “x-scoring”: scoring points against the government’s scorched earth policy of road-building in wetlands, and scoring a different song. This would be one that sings the praises, Whitman-like, of the “exquisite colors of the world” along with the names of the Beeliam region’s living creatures—bandicoots, possums, kangaroos, echidnas, and honeyeaters—while at the same time excoriating the “inorganics of modernity,” itself an epithet for overburden and the extractive economy.

Kinsella’s poem “translates” the violence of producing overburden (by bulldozers) by recovering the resources of translational materialism. It remains a challenge to define this materialism precisely, but surely that is just the point: we are in a period of translation theory in which the “matter” of translation is being rethought, both as surplus, as mined material, and as language; as language which is at once metaphoric and distinctly material insofar as it is indexed to modes of extraction, to the production of waste, environmental harm and industrial exploitation. In Kinsella’s ecopoetic idiom we find a form of translational materialism that counteracts the effects of what Michael Cronin in his recent book on “eco-translation” characterizes as an “unquenchable desire for data” accumulation that has very “tangible environmental impacts.” Such “maximalist” technologies, he maintains, favor the creation of “monolingual monocultures that are deeply inimical to the viability of resilient and diverse knowledge spaces.”²⁷ Invoking the names of local flora and fauna, and summoning the material soundings of his own voice against the din and racket emitted by the bulldozer, Kinsella makes the poetic case, not unlike the one that was made at Standing Rock, for linguistic biodiversity and a politics of translation that refuses to consign the plethora of languages to the category of overburden.

- 1 Katrin Ettenhuber, *Donne's Augustine: Renaissance Cultures of Interpretation* (Oxford: Oxford University Press, 2011), 63.
- 2 "C'est dans les profondeurs de la terre que la nature s'occupe de la formation des mines; & quoique cette opération soit une de celles qu'elle cache le plus soigneusement à nos regards; les Naturalistes n'ont pas laissé de faire des efforts pour tâcher de surprendre quelques-uns de ses secrets." Paul-Henri Thiry, Baron d'Holbach, "Mine," *Encyclopédie*, vol. 10, 521.
- 3 Julien Laroche, "L'archéologie chez Michel Foucault" (master's thesis, University of Montreal, Quebec, 2013). Translations from this text are my own.
- 4 Michel Foucault, "Les monstruosités de la critique," *Dits et Ecrits I*, (Paris: Gallimard, 2001), 1089. Foucault is responding to George Steiner's review "The Mandarin of the Hour: Michel Foucault" *The New York Times Book Review*, no. 8, February 28, 1971, 23–31.
- 5 Michel Foucault, *The Order of Things: An Archeology of the Human Sciences*, trans. A. M. Sheridan Smith (New York: Random House, 1970), xii.
- 6 *Ibid.*, 218.
- 7 Michel Foucault, *The Archeology of Knowledge and the Discourse on Language*, trans. A. M. Sheridan Smith (New York: Pantheon Books, 1972), 3.
- 8 *Ibid.*, 138–139.
- 9 *Ibid.*, 139.
- 10 *Ibid.*, 140.
- 11 *Ibid.*, 140. See also Emily Apter, "Translation with No Original: Scandals of Textual Reproduction," *The Translation Zone: A New Comparative Literature* (Princeton: Princeton University Press, 2006).
- 12 Foucault, *The Archeology of Knowledge and the Discourse on Language*, 147.
- 13 *Ibid.*, 148.
- 14 *Ibid.*, 152.
- 15 Frederic Jameson, *The Prison-House of Language: A Critical Account of Structuralism and Russian Formalism* (Princeton: Princeton University Press, 1972), viii.
- 16 Bernhard Siegert, *Cultural Techniques: Grids, Filters, Doors, and Other Articulations of the Real* (New York: Fordham University Press, 2015).
- 17 Jameson, *The Prison-House of Language*, v.
- 18 Semasiological is a term referring to cognitive semantics. See Mario Carpo, "Big Data and the End of History," *Perspecta* 48 (2015): 46–59, 46.
- 19 Sarah Allison, Ryan Heuser, Matthew Jockers, Franco Moretti, and Michael Witmore, "Quantitative Formalism: an Experiment," *Pamphlets of the Stanford Literary Lab* 1 (January 2011).
- 20 Franco Moretti, "'Operationalizing': or, the function of measurement in modern literary theory" *Pamphlets of the Stanford Literary Lab*, no. 6 (December 2013), 9.
- 21 Christopher Prendergast, "Pirouette on a Sixpence," *London Review of Books* 37, no. 17, 10 September, 2015.
- 22 Joanna Drucker, "Humanistic Theory and Digital Scholarship," *Debates in the Digital Humanities* (Minneapolis: University of Minnesota Press, 2012), 85.
- 23 Jennifer Wenzel, "Afterword: Improvement and Overburden," *Postmodern Culture* 26, no. 2 (January 2016).
- 24 Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (London and New York: Verso, 2014), 12.
- 25 Wenzel, "Afterword: Improvement and Overburden."
- 26 John Kinsella, "Bulldozer." Reproduced here with kind permission of the poet.
- 27 Michael Cronin, *Eco-Translation: Translation and Ecology in the Age of the Anthropocene* (New York: Routledge, 2017), loc. 248 and 249, Kindle. Cronin delves into what he means by data accumulation's environmental impact in a section of the book devoted to the "damagingly real" environmental effects of virtual communication technologies. See in particular, locations 2354–2393, where, (building on McKenzie Wark's articulation of the relations between medial infrastructure and extractionism in *Molecular Red: Theory for the Anthropocene*), Cronin enumerates multiple ways in which ICT manufacturing expends immense energy resources for information processing and relies on the mining of precious metals for the production of data-transmitting devices.

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An Inversion

Robin Kelsey

An Inversion



In his 2015 article “Against the Anthropocene: A Neo-Materialist Perspective,” historian Tim LeCain argues that the term “Anthropocene” succumbs, however unwittingly, to the hubris of anthropocentrism. Humans acquired their destabilizing empowerment, he says, “only at the price of throwing their lot in with a lot of other things, like coal and oil, whose powers they only vaguely understood and certainly did not really control.”¹ LeCain advocates granting these substances and their attributes significant historical agency, recognizing the unexpected ways in which they have “shaped humans and their cultures.”

According to LeCain’s logic of shared agency, we did not create our climate problem on our own. The abundant resources of the planet have aided and abetted us. They have beckoned us with a siren song of immense reserves of available energy. From this angle, nature seems less benevolent than many strains of romantic environmentalism would have us believe. As LeCain puts it, “some seemingly beneficent and nurturing planets—like those with easily accessible deposits of coal and oil, for example—might not really be all that hospitable to intelligent life” after all.²

With his neo-materialist turn of argument, LeCain provocatively critiques the habit of making our climate predicament a morality play featuring humanity as its sole actor. His reasoning suggests that we stop imagining the earth as an Eden despoiled by shortsighted exploitation of its resources and begin holding it responsible for its abundance of dangerous fossil fuels. The point is less that this critique tends to let humans off the hook (although the implications of that effect are worth pondering), and more that any moral story of the accelerating changes to global climate hinges on how we allocate agency. The term “Anthropocene” preserves our habit of locating a monopoly of agency within ourselves, making us either the failed stewards of our Eden or the technological heroes who can geoengineer our planet into a more reliably hospitable state. By granting some agency to the materials around us, we curb this habit, and allow roles for players such as coal, methane, and oil.

With agency, we might say, comes both power and accountability. If we impute all agency to human beings, then the earth and its materials maintain a passive innocence; they wait until acted upon by *Homo sapiens*, who then bear full responsibility for any havoc that ensues. But if we impute some agency to the tricky materials with which the planet and its atmosphere are composed, a more complex moral story emerges. We might think of ourselves as mischievous and clever beings, surrounded by mischievous and clever materials. Like impish children left together in a basement to play, we biological beings and our geological cousins have discovered ways of interacting that may bring down the house.

In certain respects, the materialism that LeCain proffers is more in keeping with ancient creation stories than with the declensionist narratives that have marked US environmentalism. Unlike the immaculate Eden of the Sierra Club calendar photograph, the Eden of Genesis features a substance that is both tempting and dangerous. The story of Eve's incapacity to resist her desire for the fruit of knowledge and the urgings of the serpent to taste it has moral ambiguity. Is Eve to be condemned or to be pitied? What kind of God would put such temptation in reach? Like the story of Zeus giving the jar to Pandora, the account of Eve and the Tree of Knowledge might today recall the legal doctrine of entrapment. According to that doctrine, culpability is mitigated if authorities engineer circumstances to produce an offense that otherwise would not have been committed. Although that standard might not get Pandora or Eve acquitted, the fact remains that neither chose the conditions under which a singular temptation overpowered her. By granting coal, oil, and natural gas some agency in their use as fuels, LeCain brings an old moral ambiguity to a new environmental condition. As Eve gained knowledge from the fruit, we too have gained enormous knowledge and power from our hydrocarbon troves. Just as Eve was never the same again, we have changed in fundamental ways due to plucking energy from these underground sources. Out of curiosity and desire, we have become oily and gassy beings. We have cast our lot with the flammable remains of the dead. The effects of this transformation for the earth are legion, including a looming mass extinction.

I recently thought about LeCain's materialist critique while watching *Old Faithful Inversion* (2012), a video loop by artist Greg Stimac. Stimac made the video from an eight-second clip of someone's vacation footage that he pulled off the internet. By inverting the color, he turned Old Faithful, a famous geyser in Yellowstone National Park that reliably erupts every hour or two, into something resembling an oil gusher, continuously spewing dark spray into a copper-colored sky. The work converts the reassuring clock-like renewal of "Old Faithful" into a dystopian image of continuous expenditure. With the wait between eruptions eradicated, the gusher seems a sign of our new temporality, an endless present of streaming data. The frothy white of the expelled liquid has turned to black, visually linking its ceaseless streaming—as the streams of the internet are materially linked every day—to our rapacious dependence on extracted fuel.

We can understand Stimac's *Old Faithful Inversion* as a comment on our lost connection to the restorative cyclicity of nature. This interpretation would register the seamlessly looped editing and color inversion as stand-ins for the technological mediations and modern economies that distance us from the regular rhythms

of the biosphere. The commercially driven habits of our time have cleaved us from the experience of seasons, moon phases, hydrological pressures, and the like. Indeed, our lifeworld seems hell-bent on overcoming natural cycles. The global market provides fresh summer berries year-round, and the internet instantly delivers images and sounds from whatever moment our whims desire. According to this view, the video loop reproduces our captivity within a technological frame, reminding us of our separation from the temporal processes of our ecology. The wan and hoary colors of the loop associate this distance with deprivation and sterility.

This declensionist interpretation of *Old Faithful Inversion* aligns the work with recent critiques of the untimeliness of our times. In his 2013 book *24/7: Late Capitalism and the Ends of Sleep*, Jonathan Crary observes that capital has systematically sought ever more of our time and attention. In the age of the internet, being connected means giving corporations and their advertisers access to us day and night. While advertising-driven digital video streams assault us at gas pumps, taxi backseats, airports, bars, and convenience stores, we do our share by checking our devices at least every few minutes, making sure our corporate overlords have ready access. Crary traces “24/7,” a casual tag for a newly unrelenting way of life, to a longstanding eradication of cyclicity, privacy, and restoration for the sake of profit. “In related ways,” he writes, “24/7 is inseparable from environmental catastrophe in its declaration of permanent expenditure, of endless wastefulness for its sustenance, in its terminal disruption of the cycles and seasons on which ecological integrity depends.”³ Stimac’s inversion is a 24/7 Old Faithful, a geyser that never rests, and thus never gives us leave to look away. His video offers us a mechanically reproduced environment with no hope of genuine renewal.

Keeping more with LeCain’s neo-materialism, we might also understand Stimac’s video loop as commenting on the complicity of the earthy powers that have fueled our modern dreams. According to this interpretation, Old Faithful is not a symbol of nature’s wholesome cyclicity from which technological mediations now alienate us, but rather a false friend that is in cahoots with our extractive addictions. Like a dope peddler, Old Faithful has misled us with promises of replenishment, of an eternal return of exhilarating bounty. Meet you back in the park in an hour or two, the geyser assures, and I will offer you more of the same.

By turning the white froth black, Stimac reminds us of the entwined history of Old Faithful and oil gushers. Lands now preserved as National Parks were explored and mapped by federal surveys seeking to facilitate economic development and resource extraction. The US government chose to preserve Yellowstone because it deemed it more valuable as a sign of wondrous plenitude

than as a direct source of mineral or agricultural wealth. From this history emerged an interlocking symbolism. Geysers and gushers both became tourist attractions in industrializing America, sights redolent of New World abundance and prosperity. In 1901, Frank Trost sold many thousands of prints or postcards of his photograph of the Lucas Gusher at Spindletop, Texas, and the image appeared in newspapers throughout the country. Meanwhile, images of Old Faithful offered a reassuring sign that the power of the US landscape was self-renewing. By visually melding frothy water and spewing oil, Stimac provocatively suggests that his inversion simply reverses a prior one. As a false promise of endless and regular replenishment, Old Faithful has long been a whitewashed gusher.

As Stimac evidently understands, inversion governs our extractive compulsion. In the alchemy of modern energy systems, the dark and dirty substances of coal and oil yield brilliant forms of illumination. Drawn from the endless night of underground tunnels and deep rocky pockets, these substances magically deliver lamps and lights to drive away the dark. Even when used for machine power, fossil fuels seem to magically yield something bright and airy. After Old Faithful was named by an expeditionary team in 1870, it quickly became a natural imprimatur for the age of steam, a sign that nature itself approved of the conversion of underground reserves into regulated boiling power. In *Old Faithful Inversion*, the sign of the geyser is re-inverted, turned back into the darkness of fossil fuels, as the blighted landscape is returned to the dead.

Today, Stimac's reinversion of this inverted relationship is particularly resonant. The alchemy of the modern energy is faltering. The light and invisible gases released by burning fossil fuels are betraying their dark and heavy origins. We find ourselves trapped in a techno-economic loop of fascination and expenditure. Having cast our lot with carboniferous remains of prehistoric organisms, we have run ourselves out of time. If we are to invest human life in other materials, to open other futures and make other selves, now is the only time left.

1 Timothy James LeCain, "Against the Anthropocene: A Neo-Materialist Perspective," *International Journal for History, Culture and Modernity* 3, no. 1 (March 2015): 1–28, 4.

2 *Ibid.*, 5. I would revise the suggestion to say, "not hospitable to the sort of intelligent life that humans have historically delivered." As cognitive

psychologists have repeatedly demonstrated, our intelligence is of a peculiar and habitually wayward kind.

3 Jonathan Crary, *24/7: Late Capitalism and the Ends of Sleep* (London and New York: Verso, 2013), 10.

Living with Fire
(Hot Media)

Stephanie LeMenager



A firestorm is a fire whose intensity is so great that it creates and sustains its own weather—its own wind system, to be more precise. The Horse River Fire that devastated the town of Fort McMurray, Alberta in 2016, for instance, generated pyrocumulonimbus-driven lightning: fire-generated clouds that produced lightning which, in turn, ignited or reignited more fires. Altogether, Horse River burned 1.4 million acres. Firestorms used to be freaks of weather, but are becoming more common. The frequency of megafires, fires that burn at least 100,000 acres, has also increased. Climate change is one factor in the uptick—warmer, drier weather brings more fire, creating fuels (dry brush, lightning, etc.).¹ But the frequency of megafires also has to do with the increased proportion of the landscape called intermix: environments where residential or industrial use spills into wildlands. “In the United States, there are now more than forty-six million single family homes, several hundred thousand businesses, and 120 million people living and working in and around the country’s forests,” writes the Canadian journalist Edward Struzik.² Despite national programs intended to build resilience into forest communities, like Canada’s FireSmart and FireWise in the US, “homes built within a stone’s throw of a forest continue to be built with highly combustible cedar-shake shingles and flanked with ornamental cedars.”³ I recall a photograph of burning cedar topiary in Ventura, California—my old hometown—amongst the news images of Southern California’s Thomas Fire of December, 2017. The topiary, symmetrically framing the entryway to a hillside home, was lit by flame at the top, like candles. Our high-end real estate, edged against forests, tucked into hillsides, offers an accumulation of fuel.

The scaling up of fire into pyrocumulous weather across North America has to do with a human failure to interact with fire in creating healthy ecosystems. This failure is attributable in part to the reimagination of fuel as carboniferous matter to be worked through internal combustion, an imaginative shift made during the industrial revolution. Cultural theorists Nigel Clark and Kathryn Yusoff argue that the cultural study of energy ought to be “combustion-centered” in the long human history of “artisanal pyrotechnologies” rather than fixated, as it has been, on the relatively short reign of internal combustion.⁴ The industrial revolution marks the beginning of a move away from fire as work humans do outdoors or in the relatively open space of the household hearth (the latter now conceived as a health hazard). “Fire is an extraordinarily interactive technology,” writes fire historian Stephen J. Pyne, “and humans can create powerful synergies by felling, ringbarking, grazing, sowing, pruning, digging, transplanting, moving species, and otherwise rearranging fuels and the patterns of fire.”⁵ The industrial revolution, the modern science of forestry, and the invention of public

wildlands in the US and Canada curtailed both indigenous and settler-agricultural uses of fire. Both the scaling up of megafires into firestorms with their self-generated weather and the greater likelihood of megafires themselves are the products and the effects of colonization. The North American landscapes made by indigenous fire tenders and desired by settlers—who occupied the indigenous lands they admired and in some cases learned from or imitated indigenous fire tenders—are largely gone, at a time when only about three percent of US residents are farm workers.⁶ Modern agricultural landscapes are fossil fuelscapes, whereas wildlands, without the deliberate use of fire as an agent for thinning mature trees, become accumulations of fuel to spark massive, destructive fires.

“Academic forestry, betraying its agronomic origins, condemned fire as superstitious, slovenly, wasteful, primitive,” Pyne laments.⁷ Massive settling and roadbuilding in the North American West of the late nineteenth century, including the creation of transcontinental railroads, created new fire corridors, landscapes of hasty construction and waste. The Gilded Age, Pyne tells us, was conceived by some elites—those with an eye toward European forest management—as “an environmental potlatch in which the frontier folk and the monopolist robber barons had gleefully heaped the nation’s natural wealth into flames.”⁸ This historical association of American decadence with fire ignored the pyrogenic character of many Western regions, like boreal forests, and many fire-friendly, Western species. Pyrophytes are plants that have adapted to tolerate fire; pyrophiles are plants which require fire to complete their cycle of reproduction. The North American West has plenty of both, and there is significant scientific evidence that Western wildlife, too, benefits from fire—including increasingly scarce species like flammulated owls and spotted owls.⁹

The benefits of fire to animals arise from relatively low-intensity, naturally occurring wildfires, not from the new breed of megafires attributable to the cessation of Native American and rural controlled burning, an irreplaceable means of resource management.¹⁰ As early as the start of the twentieth century, California foresters recognized “Indian” intelligence on tending fire, and by the 1940s the science of fire prevention in the US recommended controlled burn, but fire suppression remains primarily the work of federal agencies. And as sociologist Kari Norgaard has shown, native Californian tribes like the Karuk have been harshly punished for trying to nourish and protect their traditional lands with fire.¹¹ Meanwhile, moribund twentieth-century infrastructures like aboveground power lines continue their tentacular reach into drier forests, exurbanites drive their Range Rovers onto the Bureau of Land Management’s brush-lined gravel roads, private homes spring up on the edges of wildlands, and oil pads live within them.¹² The very

love of the wild instigated by North American environmentalism has generated an accumulation of tinder. Fossil fuel modernity made necessary, for some, the establishment and dream of wildlands. It now invades and privatizes wildlands, fanning the flames.

Insofar as fire fuel is a character of modern North American landscapes that signifies how they act as accumulations of tinder, it is also fire media. In other words, the dry brush, immature trees, pine needles, and other fuels of untended wildlands are expressive carriers of narrative and affect. Fire fuel tells a story of the urban settler ignorance of fire, and it is that story.

That said, fire generates deliberate media experiments, too. Modes of orientation toward fire reflect the complex of urban values that fire historians and fire ecologists point to as foundational to the settler/urban inability to recognize fire as an ecological tool. Historian Mike Davis has written extensively about the mediatization of Southern California as an apocalypse theme park, noting how fire has been demonized as a kind of intruder into a Mediterranean climate that in fact depends upon fire for its health.¹³ My own experience as a Southern Californian for fifteen years, and now as an Oregonian for five (in a region hit so hard by wildfire in late summer that I own a smoke-filtering mask) calls to mind a different kind of mediatization: fire-orienting media for the Anthropocene. The photographic, filmic, and cartographic media of megafires—especially abundant in online formats—describe relationships between the human subject and fires so overwhelming as to defy any knowledge we might have (even theoretically) of fire as a Neolithic or contemporary ecological tool. These media do not claim that humans and fire have been long-term collaborators in landscape design, nor that humans suppress fire in a triumph of Enlightenment modernity. Rather, they present the idea that fire is its own reality and, as with firestorms, its own weather, a mode of time (*temps*). If we consider time as an incredibly intimate media concept, insofar as it may express the experience of the human body and even species, what might it mean for “time” to be felt as explosive, multi-sited, and unpredictable—*megafire time*?¹⁴ Natural time has become a kind of ambient trauma, dealing death to some and leaving survivors to tend the ruins or figure out how to get beyond the perimeter of the latest incident.

The graphic and data journalist Joe Fox created a virtual environment of megafire for the *Los Angeles Times* in January 2018, when the Thomas Fire was contained. Titled “The Thomas Fire: 40 Days of Devastation,” this interactive satellite map with a 3D terrain layer presents the fire through black narrative text boxes linked to specific satellite images. Lighter-colored instructional text boxes—like an author’s footnotes—hover in the midst of specific images. The viewer can “drag the map to look around” and flip an individual

image on its axis to appreciate the 3D terrain layer. The narrative of the map progresses by way of the viewer clicking on a “next” tab, and is structured as a daily diary or incident report. Links in most narrative text boxes make possible a closer examination of a particular day’s progress.

The “God’s-eye view” made available by this map is both enlightening and infuriating. How can it be that a media tool as sophisticated as this coexists with a culture so profoundly vulnerable? The sophistication of this media intelligence suggests a culture already having given up on earth’s ecologies, honing its skills elsewhere. What is the relationship of the photographs showing moribund and poorly sited infrastructure—car-choked highways surrounded by flames, devastated suburban plats—to this gorgeous, interactive media? By the time Fox brings us to Day 38 (“281, 893 acres burned” and mudslides inundating the coastal town of Montecito), the narrative has developed an almost wry tone. “At least 100 homes were destroyed, and at least 21 people were killed, including some outside the mandatory evacuation zones.” Small red dots on the map image indicate where bodies were found among Montecito’s hillside homes—we see only two red dots in the mandatory evacuation zone, and the rest in the voluntary zone. As I count the red dots, I flip the map so that the mountains are vertical—almost a nervous preference for visual orientation to the human POV—and I search the hillsides for the area where I think an old friend of mine still lives, in a rented cabin. We used to ride horses up there together, winding around chaparral trails and stumbling into the grounds of elegant mansions. She’s a hermit, and I’m not sure she has a cellphone. I wonder if she, and her horse, are alive. Am I angry at this interactive media, almost a “game” version of tragedy? Not really. It has, after all, shown me how the fire moves. I am simply made uncomfortable by its visually arresting assurance, in juxtaposition to the chaotic, raw story it rationalizes. That incongruity reads a bit like a joke. (Maybe a rather old one, circa Chaplin’s *Modern Times*).

Day 40. The interactive map closes, suggesting I conduct my own exploration, outside of narrative time. In terms of memory, for those who lived through it or know these places, the Thomas Fire has no narrative—an end, yes, but no therapeutic closure.

Online newspaper photographs—of charred avocado and orange trees at a market farm I used to visit in Santa Paula, the rural town near where the fire originated, and photographs of a charred mental health facility where a friend worked—vividly recall scenes of habitual living in and around Ventura in the early twenty-first century. I lived in a West Ventura neighborhood, near to the inland town of Ojai, for seven years. It was shocking to see my former everyday—with both the comfort and boredom that term

implies—blackened and broken. In the first few days of the Thomas Fire in early December, I tried phoning my former next-door neighbors, but did not receive an answer. It was probably because they evacuated, but I have yet to reconnect with them. Another neighbor recounted the terror that she and others felt as the fire descended, the rapidity and absoluteness of its force—and this in an area where “hill fires” regularly occur. When the hill burned on its fairly regular, three-year cycle, neighborhood residents climbed onto their roofs with garden hoses. Southern Californians are used to suppressing—and even enjoying—their apocalypse theme-park. But the Thomas Fire scaled up far beyond creative, local response, resulting in the destruction of six hundred apartments and homes, twenty-three human deaths (two attributable to the fire, the rest to the mudslides), and the deaths of more than sixty-six horses.¹⁵ Its destruction was, and still is, traumatic. It was, briefly, the largest fire in California history, before being overtaken by the Mendocino Complex fire in 2018.

In the first five days of the Thomas Fire, no maps that I could find online made clear exactly where the burned houses were, exactly which neighborhoods were in the fire’s path, and which escaped it. I learned more as I reached friends by telephone. I know of no close acquaintances who lost property or life to the fire. My old neighborhood remains intact. For the seven years that I lived in that neighborhood, we fretted under the rolling landscape we called “the hill,” with its periodic fires and known risk for landslide—this landslide risk now a point of interest on Google Earth. We were a plucky neighborhood of Latinx, immigrants, and queers, considered both the bad part of town and the arts district. This time, neither the fires nor the slides got us. Aging electrical infrastructure still hangs precariously over the old neighborhood—many of its houses from the 1920s still wired with knob-and-tube. California, like the rest of the West, gets hotter, drier. The landslide looms, waiting for the next El Niño.

Pyne, the fire historian, makes clear how ignorant suburban and urban people are of the rural uses of fire and how this ignorance primes us to live in places and in habitats that accumulate fuel for megafires. While I largely agree with Pyne’s description of my demographic (I identify here as a settler/urbanite), I would quibble with his insistence that our primary means of conceiving fire is through the demonizing lens of mainstream environmentalism—which has turned fire into a weapon against Nature since the debut of the film *Bambi* in 1942.¹⁶ The source of my ignorance of fire can be located in another kind of media: InciWeb, a website well known to all US Westerners, and its analog predecessors. My relationship to fire has not been one of imagined antagonism, where I denigrate rural and indigenous fire tenders for torching the wilderness that makes my (sub)urban existence bearable. Yet the

relationship I have to fire comes from a related strain of ecological and cultural blindness. My understanding of fire originates in a (sub)urban/settler image of wildlands, and much of the West, as sites of recreation. The way this relationship plays out is through driving. Driving to hike, to swim in a mountain lake, to kayak. Every time I drive east, toward Oregon's high desert, for example, I check InciWeb for fire. Which roads you take, where you gas up, where you stay overnight, depends on where the fires are burning. It is not a matter of "if" they are burning. We assume fire, in late summer and early fall. Our task is to move around it. That pragmatic living with the fires of a desired elsewhere—in our diminishing and disrespected rural regions, in so-called wildlands—as if they are minor traffic frays to avoid, may be an even more potent imaginative block to building resilience to megafire than would be an explicit bias against fire.

Before you go anywhere, check InciWeb. Of the eighty-five percent contained "Boxcar Fire" in central Oregon, InciWeb recently told me: "The Deschutes and John Day Rivers, boat launch sites, camping areas and highways are open for recreation." But: "Visitors should use caution while driving as rocks may dislodge and become a hazard along the roads. If precipitation occurs, flash flooding can move large amounts of soil and debris. Always be aware of potential hazards when moving through recently burned areas."¹⁷ Why did so few residents of Montecito who were in the Thomas Fire voluntary evacuation zone choose to evacuate, such that twenty-one people died? Fire's relative normalcy in the West, for (sub)urban recreationists, makes megafire and its corollaries, like mudslides, even more potent adversaries. The New West's familiarity with wildfire is itself an accumulation of fuel. Fatal tinder.

Thanks to Heather Houser for explicitly identifying the genre of this map and for her innovative work on the "infowhelm" in the era of climate change.

- 1 See Tania Schoennagel, Jennifer K. Balch, et al., "Adapt to More Wildfire in Western North American Forests as Climate Changes," *PNAS (Proceedings of the National Academy of Sciences)* 114, no. 18 (May 2, 2017): 4582–4590.
- 2 Edward Struzik, *Firestorm: How Wildfire Will Shape Our Future* (Washington DC: Island Press, 2017), 5.
- 3 Struzik, 15.
- 4 Nigel Clark and Kathryn Yusoff, "Combustion and Society: A Fire-Centered History of Energy Use," *Theory, Culture, and Society* 31 (July 2014): 203–226.
- 5 Stephen J. Pyne, *America's Fires: Management on Wildlands and Forests* (Durham, North Carolina: Forest History Society, 1997), 14.
- 6 This somewhat outdated figure comes from Pyne, *America's Fires*.
- 7 Pyne, 16.
- 8 Pyne, 6.
- 9 Struzik, 223.
- 10 Struzik, 224.
- 11 See Kari Norgaard, "The Politics of Fire and the Social Impacts of Fire Exclusion on the Klamath," *Humboldt Journal of Social Relations*, no. 36 (2014): 77.
- 12 Kendra Atleework, "Power Lines Are Burning the West," *The Atlantic Monthly*, May 25, 2018.
- 13 Mike Davis, "The Dialectic of Ordinary Disaster" in *The Ecology of Fear: Los Angeles and the Imagination of Disaster* (New York: Metropolitan Books, 1998), 9.
- 14 This is essentially Amitav Ghosh's argument about the temporality of realism and/or Nature during the era of climate change. Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (Chicago: University of Chicago Press, 2016), 20–21. See also Davis.
- 15 Brittny Mejia, Harriet Ryan, and Paul Sisson. "An Unprecedented Loss of Life: The grim toll of Southland fires on animals born to run," *The Los Angeles Times*, December 9, 2017.
- 16 Pyne, *America's Fires*, 22.
- 17 "Boxcar Fire: Incident Overview," National Wildfire Coordinating Group (NWCG), June 27, 2018.

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Redistributions

Cymene Howe
and Dominic Boyer

Accumulation figures prominently in the environmental concerns of the twenty-first century. Greenhouse gases accumulate in the atmosphere. Toxins accumulate in biomes. Plastic accumulates on land and sea and in avian and aquatic forms of life. Waste accumulates on the margins of settlements and industry. These forms of accumulation are closely tied to the Northern, capitalist modernity whose world hegemony was achieved through colonialism and imperialism. Accumulation marks this modernity's relentless work to constitute and drain resource frontiers, its making of things wildly in excess of need, its solicitation of avid and restless consumption, and its obscuring of the limits and consequences of a growth- and luxury-oriented economy.

Accumulation originated as a concept in early modern Europe as part of a new lexicon related to the growth of the thingly world. Literally, "accumulation" meant the act of making heaps. Our contemporary concern with heaping maintains this broader attention to thingly amassment—beyond the environment, we also live in a time of mounting awareness of the efficacy of growing heaps of capital, weapons, income, and power. Yet as much as some heaps are coming together, other heaps are coming apart. And still other things are undergoing phase shifts in reaction to other modes of physical and social accumulation. For if there is one thing not accumulating in the twenty-first century, it is ice.

Dis-accumulation by Accumulation

Over the last two decades, ice has become a climatological signal, rendering visible the rising temperatures of anthropogenic climate change. As ice melts, both heat and its carbon source are made visible. Diminishing cryospheres have become observable, materialized sites of atmospheric accumulation, as greenhouse heat works its way across and through the bodies of ice forms. Put another way, accumulation in the atmospheric domain creates "dis-accumulation" in the cryosphere.

Polar ice melt is widely understood as the key index that temperatures at the planet's axes are increasing dramatically. And ice is nowhere melting faster, and faster than expected, than in the Arctic region.¹ The Intergovernmental Panel on Climate Change (IPCC) considers glacial diminishment to be the "highest confidence temperature indicator in the climate system."² Scientists have also concurred that the rate of melt in polar zones has been considerably underestimated.³ The transformation of the world's ice, and the implications of this cryo-human outcome are vivid indicators of what Timothy Morton has called the "Age of Asymmetry."⁴ However, the asymmetrical distribution of climate crises, and the

skewed centers of power and resource exploitation that have created them, also reveal a kind of symmetry: an equivalence between melting cryospheres and carbon-intensive modernities.

Few places on earth have experienced the great melting more dramatically than Iceland, where ten percent of the island's surface is covered by over four hundred glaciers and ice caps. Since human settlement in 874, glaciers have played an important role in Icelandic culture and history, most often as an ominous presence, threatening to displace villages with encroachment or to destroy homes and farms with glacial outburst floods.⁵ Iceland's glaciers are now losing eleven billion tons of ice per year, and scientists predict that by 2170 all the country's glaciers will be gone.⁶ In their disappearance, Icelandic glaciers index atmospheric temperature elevation. As they recede, failing to regrow and re-accumulate their mass, they become observable signs of atmospheric carbon dioxide accumulation that global capitalist modernity has abetted and accelerated.

As glacial ice expires and sea ice diminishes in its extent and thickness, a familiar extractive logic has also come to occupy the Arctic region. New shipping routes are being cleared by the loss of sea ice and mineral stores are becoming more easily accessible to mining.⁷ The Arctic appears steadily poised as a new frontier for extraction, commerce, and development in the high North. Yet media attention about the melting Arctic often emphasizes the potential for sea level rise in the lower latitudes. Or, in more locally attentive reporting, it highlights the catastrophic conditions facing Indigenous communities and subsistence hunters who rely on seasonal freezing and ice pack for their livelihoods. Thus, while melting cryospheres tend to focus worry upon future harm, some responses have lauded the potential for increased capital accumulation created through lost ice. Some Greenlanders, for instance, have embraced ice reduction because it will increase access to mineral and hydrocarbon resources.⁸ Several Icelandic politicians have likewise celebrated the possible economic windfall of the great melting, arguing that warmer conditions represent a boon for northern nations because this will make agriculture and resource extraction more practical and economically viable.

The Northern Sea Route—which was previously passable only two months of the year—was traversed for the first time by shipping vessels without an ice breaker in 2017. By 2040, parts of the passage are expected to be entirely free of sea ice year-round with far-reaching consequences for local populations and ecosystems. The logistics hub for this Northern Sea Route has been slated for construction in northern Iceland, and will be funded in part by Chinese investors.⁹ As ice recedes on land and on the sea's surface, hydrocarbon exploration and extraction are projected to increase.

However, little infrastructure is in place to treat oil spills or other accidents if the twenty-five percent of the world's remaining carbon fuel reserves located in the Arctic are to be extracted. The consequences of burning these carbon reserves of course, have implications far beyond the Arctic. While the polar North continues to shed its icy skin and reveal to the world the rapidity of climate warming, it is also a place where capital accumulation is being remade in the wake of cryospheric dis-accumulation.

The Motility of Glaciers

Each summer, Professor Guðfinna Aðelgeirsdóttir journeys to Sólheimajökull, a glacial tongue about two hours southeast of Reykjavík, with a group of university students. There, they use a steam drill to bore through glacial ice, a process that Guðfinna describes as similar to sinking a hot knife through butter. Once pierced, a long wire is lowered down ten meters into the body of the glacier. As snow and ice on the glacial surface accumulate, compact, and then melt away, Guðfinna and her students are able to observe the diminished thickness of the ice. The more visible wire that emerges from the narrow hole, the less ice is present. Guðfinna describes it as a very simple, low impact way to measure ice that once was.

Glaciologists are keenly attuned to accumulation as a technical term in their scientific practices. Accumulation is what makes a glacier a glacier. It is what gives a glacier not just mass, but movement. Guðfinna explains that glaciers are anything but static. In fact, she says, they are best understood as operating like a conveyor belt. They move, and they move material. Snow and ice accumulate in the higher altitudes of the glacier and are depleted in the lower reaches. Frozen materials move from high to low, and from solid to liquid. Glacial vitality, its ability to move under its own enormous weight, is determined by accumulation in the colder months, offset by the “ablation” processes of melting and calving in the warmer months. Of course, there are many more warmer months now, and fewer cold. Accumulation has thus slowed, while melt has accelerated.

Helgi Björnsson, one of Iceland's most renowned glaciologists, has found it useful to depict glaciers in economic terms. “They are like a bank account,” he says. In the winter, positive accumulation on the surface fills up the bank. Deposits are made at higher elevations, while at lower elevations, withdrawals occur. And just as with your accounts, he notes, you want to keep it at a healthy balance. But we know that balance is not being achieved as of late; deposits have not kept up with expenditures. Accumulation has failed to keep pace with depletion.

Icelandic glaciers are especially well documented compared to many others in the world. Since the middle ages, Icelanders have been attuned to the glaciers that occupy their homeland. Historically, the country's ice cover has varied. But since the mid 1990s, ice forms have only gone in one direction: towards "ablation."

Ablation is the technical term for ice loss. In English, the word is, in the first instance, defined as "the surgical removal of body tissue." (The first person to systematically document Icelandic glaciers was, by trade, a surgeon.) In the second definition, ablation denotes the melting or evaporation of snow and ice. In general, and historically, about half of ablation events occur through calving (cracking off of ice forms) and the other half through melting. While there have always been advances and retreats of glaciers in Iceland, the country's glaciers are now withdrawing to the point where "new land" is being uncovered by melt. Places that have been covered in ice for at least two to three thousand years are now exposed and raw.

Glaciologists are experts in "glacial response." In Iceland, and elsewhere, glaciologists recognize, for example, that earth systems have only accumulated about 150 years of intensive fossil fuel use. Glacial response to atmospheric temperature is just beginning because, as both Guðfinna and Helgi put it, it "is a slow system." It is also a "stochastic" system: with random probabilities and patterns that may be analyzed statistically but that cannot be predicted precisely.

Prior to the Fourth Assessment Report of the IPCC, glaciers and ice sheets like those in Greenland and Antarctica appeared in many diagnostic modeling tools as "white mountains," according to Guðfinna. Rather than the dynamic systems that they are—cracking, melting and moving—their representation in climate modeling took them as inert surface protrusions. But of course, ice sheets and glaciers are increasingly motile; they are dynamic entities that, among other things, are contributing to sea level rise and changing weather. As Guðfinna puts it, "This is the largest uncontrolled experiment that we humans have ever done. And we will see where it leads us."

Melt is Shape, Not Flow

Earth scientists agree that melting land ice is contributing significantly to sea level rise around the world and that continued warming will exacerbate the risks for human populations. The IPCC has reported the likely increase in sea level from the end of the 1900s to the year 2100 will be between eighteen to fifty-nine centimeters. But more recent modeling shows that land ice is melting faster than previously expected, and many climate experts now believe that an

overall sea level rise of one meter worldwide by the end of the century is more realistic. While these designations are valuable for estimating future potential harm and perhaps more importantly, for alerting populations to sea level threats, these diagnoses are limited in that they speak to a global condition—an average—while their consequences will be registered in specific locations—and to highly variable effect.

Many popular accounts of cryospherically induced sea level rise reproduce the most simplistic accounting of sea level rise, “the median global sea level.” For scientists, this is colloquially termed “the bathtub model”—essentially, that meltwater entering into the world ocean will manifest in a linear, uniform way and distribute evenly across the world’s coasts.¹⁰ This is inaccurate for several reasons, including the fact that local sea levels are determined by myriad factors, including land composition (erosion, subsidence, sediment compaction, and bedrock porosity), weather (storms, wind, and air pressure distribution), ocean circulation (waves, tides, currents, and the global ocean conveyor), and finally, global sea level fluctuation caused by thermal expansion and melting land ice. Sea level rise in particular locations will be contingent; what is constant is that hydrological changes will affect every place on earth.

As melted ice becomes integrated into the world ocean, the planet’s gravity, as well as its rotation, are shifted and create spatial patterns of sea level rise distribution around the world.¹¹ Until very recently, the relationship between future changes to earth’s cryosphere and its impact upon local sea level shifts (or sea level “fingerprints”) have made precise forecasting for coastal cities difficult. In late 2017, physicist Eric Larour, working with a team of researchers at NASA’s Jet Propulsion Lab, created and released online an interactive modeling tool—a gradient fingerprint mapping device (GFM)—that shows, with great accuracy, where freshwater melt contributions to global sea level rise are being distributed among 293 coastal cities.¹² The NASA/JPL program is currently the only tool capable of attributing specific locations of melting ice with their effects on the world’s coastal cities.

The locus of watery inundation depends on the location of ice loss. For example, local sea level rise in London is significantly affected by changes on the western part of the Greenland Ice Sheet (GrIS). Conversely, New York City’s sea level rise will be largely contingent upon changes to the northeastern portions of the GrIS. Implementing an advanced mathematical property, the GFM computational model creates a mesh to combine shoreline database material and “ice forcing” measurements from 2003 to the present, gathered by the GRACE satellites.¹³ The modeling tool can then render local sea level changes as they relate to local variations in ice thickness for all the world’s ice drainage systems, from Antarctica

to the Alps, from the Russian Arctic to the Andes and from the Himalayas to Scandinavia.

The model, however, does not follow the water from sites of melt to sites of rise. Instead, it captures the shape of the ocean, tracking its gravitational perturbations in form as ice becomes water, becoming ocean. In our conversation, Eric, the tool's creator, puts it plainly: "Melt ice anywhere and we can give you the shape that the ocean would adopt." He explains that the most complicated aspect is "sea level rotational feedback," or the change in the rotation of the Earth as ice melts.

It's like a spinning top. If you could modify the spinning top while it rotates, maybe touch it and remove some mass, it will start wobbling very differently... [A]s soon as you remove a bit of mass from that big giant spinning top, which is the Earth, the rotation axis of the spinning top wants to move towards the mass that was lost.¹⁴

Accumulation does not appear here through flow, but through the redistribution of mass.

In a circulatory model, accurately charting the movement of one molecule of melted water to its final destination could take hundreds of years of observation. The ocean conveyor is not slow per se, but it is very circuitous, hemmed and pushed by many factors. A connection between melt (here) and rise (there) thus exists, but not through a flow of melted water in one site to sea level rise in the other. The dis-accumulation of ice can be directly tied to its accumulation as sea level rise elsewhere, but precision in this operation requires a volumetric understanding of the earth's fluid envelope at scale, and in its distributive mass rather than its linear connectivity.

Conclusion

In a recent collection championing the "volumetric turn" in architecture, geography, and anthropology, Franck Billé argues that critical attention to the materiality and multiplicity of volumetric space helps to jam governing conceptions of cartography through sometimes unruly "entanglement of scales," from the planetary to the nano.¹⁵ If we extend this argument further, by engaging with the entangled sociomaterial transformations of hydrospheres, lithospheres, atmospheres, and cryospheres, we gain new kinds of critical insight and leverage upon the dominant political orders of contemporary northern modernity such as: (1) the fossil and nuclear fuel infrastructures that enable all dimensions of modern lifestyle, worldview, and governance, (2) nation-state sovereignties

that exercise their dominion principally through militarized territorial systems of citizenship, extractive economies, and border control, and (3) the financial networks whose electronically mediated forms of speculation, debt imposition, and value extraction avidly imagine themselves as transcending space, matter, and time. These are all complex, ramifying systems on their own and they often interlock and reinforce one another in the Anthropocene/Capitalocene trajectory. They are furthermore relentlessly anthropocentric and resist recognizing the material contingencies of their forms of power, let alone the calls to ecophilia that are spreading and strengthening in response to the compromise of human and nonhuman lifeworlds.¹⁶ The challenge of changing our current trajectory is, needless to say, immense and must be viewed as civilizational transformation. Only by better understanding the interconnection and redistribution of accumulations between atmospheric carbon, cryospheric mass, hydrospheric shape, and anthropospheric forms of knowledge and value can we contribute to the work of this transformation.

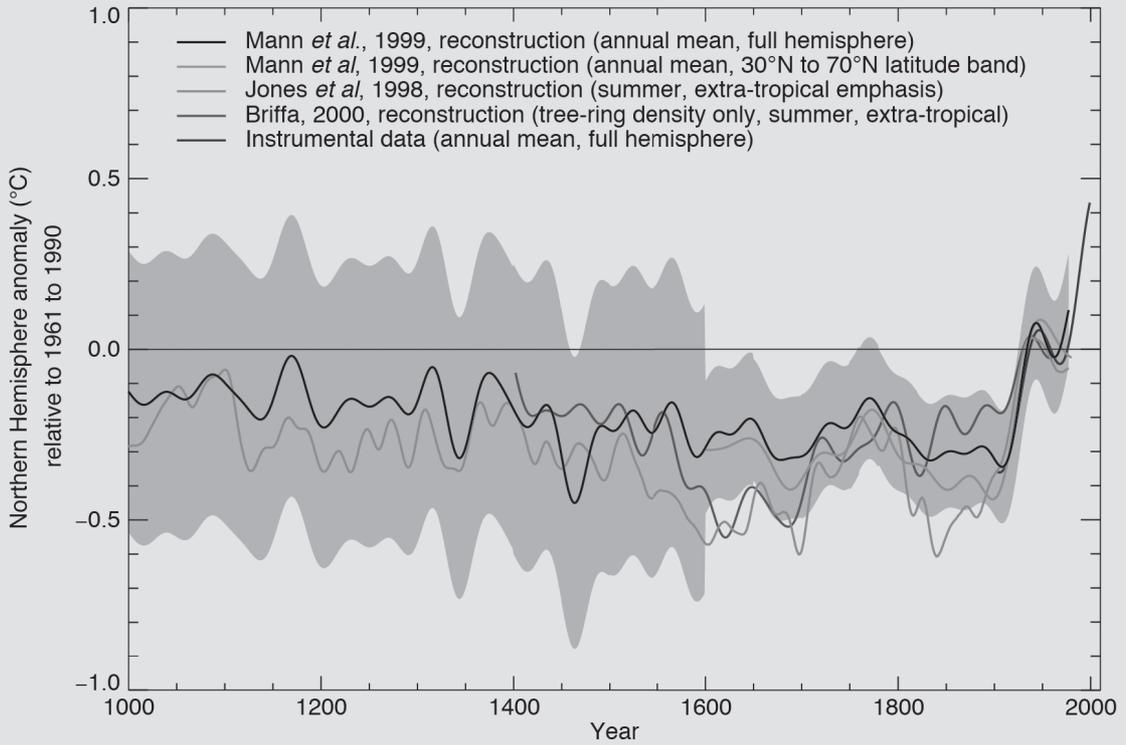
- 1 See Rose Hackman, "Arctic ice melting faster and earlier as scientists demand action," *The Guardian*, May 5, 2015.
- 2 IPCC, "Climate Change 2001: The Scientific Basis, summary for policy makers—Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change," ed. J. T. Houghton, Y. Ding, D. J. Griggs, M. Noguer, P. J. Van der Linden, X. Dai, K. Maskell, and C. A. Johnson, 2001.
- 3 The 2017 Arctic Monitoring and Assessment Programme (AMAP) report detailed that global sea levels will rise much more quickly than previously thought; the new estimates are almost double the pace predicted by the IPCC in 2013. See Dana Nuccitelli, "Global warming since 1997 more than twice as fast as previously estimated, new study shows," *The Guardian*, November 13, 2013.
- 4 Timothy Morton, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: University of Minnesota Press, 2013), 161.
- 5 By definition, glaciers are formed where winter snowfall accumulation exceeds that of summer melting or calving, allowing snow to amass on the surface and to eventually become ice. Critical thickness for glacier formation is approximately 30 meters with a density of 0.85 g/cm³. When these conditions are achieved, the existing ice deforms and moves downslope to become a glacier. Iceland is dominated by six primary glaciers. See Ingólfur Ásgeir Jóhannesson, "Icelandic Nationalism and the Kyoto Protocol: An Analysis of the Discourse on Global Environmental Change in Iceland," *Environmental Politics* 14, no. 4 (August 2005): 495–509.
- 6 See Cheryl Katz, "What is Iceland Without Ice?," *Scientific American*, December 18, 2013.

- 7 See Rasmus Gjedssø Bertelsen and Piotr Graczyk, "Establishing Shared Knowledge about Globalization in Asia and the Arctic," *Society for Cultural Anthropology*, online, July 29, 2016; *Diplomacy on Ice: Energy and the Environment in the Arctic and Antarctic*, ed. Rebecca Pincus and Saleem H. Ali (New Haven: Yale University Press, 2015).
- 8 Mark Nuttall, "Subsurface Politics: Greenlandic Discourses on Extractive Industries," in *Handbook of the Politics of the Arctic*, ed. Leif Christian Jensen and Geir Hønneland, (Cheltenham: Edward Elgar, 2015), 105–27; Mark Nuttall, "The Making of Resource Spaces in Greenland," *Society for Cultural Anthropology*, online, July 29, 2016.
- 9 Formerly called the Northeast Passage, the Northern Sea Route traverses the Eastern Arctic seas and connects the Atlantic and Pacific oceans. Seasonal variation in the Arctic is considered to be more extreme than anywhere else on earth, moving from ice-cover to lush conditions in annual cycles. The Arctic Ocean, surrounded as it is by land, is more subject to terrestrial influence than any other ocean on the planet; its hydrology is singular, on the one hand encircled by land and on the other, fed by some of the world's largest rivers (National Research Council 2014).
- 10 We intentionally adopt the oceanographic term "world ocean" to emphasize that this is a continuous body of water encircling the Earth, with relatively uninhibited interchange and transference across the world hydrosphere. Human designations of "the (Atlantic, Pacific, Southern, etc.) ocean" or "sea" may be useful geographic markers for human-imagined demarcations, but the earth's fluid envelope is not similarly bounded.
- 11 Scientists have demonstrated that terrestrial ice melting into the ocean creates a nonuniform pattern of regional sea level rise which can be tracked using "sea level fingerprints." Recently, it has been shown that ocean station measurements of sea level fingerprints correspond with that calculated from satellite measurements, which are able to determine ocean mass changes over time in local settings accounting for gravitational fluctuation. See Chia-Wei Hsu and Isabella Velicogna, "Detection of sea level fingerprints derived from GRACE gravity data," *Geophysical Research Letters* 44 (September 2017): 8953–8961.
- 12 See Eric Larour, Erik R. Ivins, and Surendra Adhikari, "Should coastal planners have concern over where land ice is melting?" *Science Advances* 3, no. 11 (November 2017).
- 13 A joint effort by NASA and the Deutsche Forschungsanstalt für Luft und Raumfahrt (DLR), GRACE (Gravity Recovery and Climate Experiment) satellites, launched in 2002, are now operating under "an extended mission" phase. GRACE is comprised of two spacecraft, 220 kilometers apart in a polar orbit, 500 kilometers above Earth. The objective of GRACE is to map the Earth's gravitational field by accurately measuring the distance between the two satellites, using GPS and microwave signals. GRACE satellites have provided data on: changes due to surface and deep currents in the ocean; runoff and ground water storage on land masses; exchanges between ice sheets or glaciers and the ocean; and variations of mass within Earth. GRACE is also being utilized to better profile Earth's atmosphere, and the project overall is seen to be making very significant contributions to NASA's Science Mission Directorate, Earth Observation System (EOS), and global climate change studies. See Pål Wessel and Walter H. F. Smith, "A global, self-consistent, hierarchical, high-resolution shoreline database," *Journal of Geophysical Research* 101, no. B4 (April 1996): 8741–8743; Michael M. Watkins, David N. Wiese, Dah-Ning Yuan, Carmen Boening, Felix W. Landerer, "Improved methods for observing Earth's time variable mass distribution with GRACE using spherical cap mascons," *Journal of Geophysical Research* 120, no.4 (April 2015): 2648–2671.
- 14 Eric Larour, in discussion with the authors, February 2018.
- 15 Franck Billé, "Introduction: Speaking Volumes," *Society for Cultural Anthropology*, online, October 24, 2017.
- 16 See Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York and London: Verso, 2011). Stacy Alaimo, *Exposed: Environmental Politics and Pleasures in Posthuman Times* (Minneapolis: University of Minnesota Press, 2016).

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On Patterns and Proxies

Wendy Hui Kyong Chun



Michael E. Mann, Raymond S. Bradley and Malcolm K. Hughes's 1999 "Hockey Stick" graph, as featured in the 2001 Intergovernmental Panel on Climate Change (IPCC) report.

What role do—and should—images play in combatting global climate change? Since we experience weather, not climate, images have been used to illustrate the effects of global climate change: from photographs of melting icebergs and starving polar bears to scientific graphs of historical temperature increases. These illustrations are proxies—stand-ins or representatives—for rising global temperatures. These image-making processes, however, have been all too successful in opening climate up to cultural inquiry and political mobilization. They have been used to both convince the public that climate change is real and to foster doubt and denial. Proxies both reduce and introduce uncertainty. By bridging the unknown or absent, they introduce the specter of the unknowable. They make politics necessary.

Crucially, the same image can foster both belief and mistrust. The *National Geographic* 2017 “heart-wrenching video [of] a starving polar bear on iceless land” on Summerset Island, for example, went viral—sparking outrage over the effects of global climate change. In response, conservative news outlets and questionable wildlife “conservation” sites, such as Polar Bears International, spread competing explanations for the bear’s condition and accused SeaLegacy of “climate change porn.”¹ The more compelling and popular the image, the more controversy, analysis, and conspiracy theories it accretes and disseminates.

This phenomenon reveals the insights and limitations of twentieth-century semiotics and cultural studies. Daily, conspiracy theorists reveal the prescience of Eve Sedgwick’s warning against paranoid reading.² Deniers perversely answer Roland Barthes’ call for polysemy and Stuart Hall’s call for resistant readings.³ As Ien Ang argued so many years ago, capitalism accelerates meaning-making and difference; it produces “postmodern audiences.”⁴ The pressing question facing us must be contextualized: what role does—and should—image-making play in combatting global climate change, at a time when critical theory itself is not dead but rather undead, constantly resuscitated via planet-destroying conspiracy theories?

The controversy over Dr. Michael E. Mann’s “hockey stick” is incisive in reflecting upon and responding to this question. Although charismatic megafauna and dramatic natural settings spark interest and debate, the most influential—and controversial—representations of global climate change are line graphs. Mann first published his graph, charting changes in mean temperature in the Northern Hemisphere from 1400 to 1995, in 1998 in *Nature*, and published an updated version, which included the period from 1000–1998, the following year in *PNAS*.⁵ The 2001 Intergovernmental Panel on Climate Change (IPCC) report featured the 1999 graph in the “Summary for Policymakers” section, and

politicians such as President Bill Clinton and Vice President Al Gore used it as proof of the impact of the human use of hydrocarbons on the climate. Simultaneously, the image was attacked both by social scientists and physicists, whose work was picked up by media outlets such as the *Wall Street Journal* and *MIT Technology Review*, and by politicians in their respective domains.⁶ Furthermore, Mann was personally attacked as a proxy for “bad science”: he and his family have received death threats; his academic records were unsuccessfully subpoenaed by Republican lawmakers; and his emails were hacked as part of “climate-gate.”⁷ Why, or perhaps how could a simple graph provoke so much anger and controversy?

Sticking to the Past

Given that Mann’s hockey stick makes no predictions about the future—the last year included in either graph was 1998—the controversy seems bizarre. Mann is a paleoclimatologist. He does not predict future climate trends via general circulation models, but rather reconstructs past climates using statistical methods and proxy data, such as measurements of tree rings and ice cores. As Mann notes, “knowing both the spatial and temporal patterns of climate change over the past several centuries remains a key to assessing a possible anthropogenic impact on post-industrial climate.”⁸ The past can thus reveal the impact of the more current use of hydrocarbons.

The 1999 graph was so controversial because it included reconstructions of the average temperature in the Northern Hemisphere from 1000–1400—during the so-called medieval warming period (also called the medieval climate anomaly). During this period, parts of Europe, China, Australia, and North America experienced unusually high temperatures. Deniers, such as President Donald Trump’s first Energy Secretary Rick Perry, use this phenomenon to claim that that oceans and the natural environment—rather than humans—are the main control knobs of climate change.⁹ The argument goes: if the earth has undergone a similar period of warming in the past, then humans cannot be blamed for the current situation. The hockey stick, however, showed that warming during the twentieth century—the blade of the stick—dwarfed any rise in temperature during this earlier period. The take-away of this was that humans are responsible for the increasing mean temperature, since the main difference between past and present is the human burning of fossil fuels.

The “scientific” attacks on Mann focused on his use of proxies and statistical methods in his mean temperature reconstruction. Mann, like paleoclimatologists before him, drew from many

different types of proxies for temperature—tree ring measurements, ice cores, ice melts, human records, etc.—that are unevenly sampled both temporally and spatially. In particular, there is an overwhelming plethora of tree ring data, which represents “only a restricted region of the globe, the midlatitude continents.”¹⁰ The other key regions—the poles, oceans, and tropics—are represented by less abundant proxies: data drawn from corals, ice cores, and lake sediments. If all proxies are treated equally, “the sheer amount of tree ring data [would] overwhelm the less abundant information from other proxy records ... [and thus] weight our results toward the midlatitude continents.”¹¹

To create a “fair fight” between these different forms of data, Mann used what is called Principal Component Analysis (PCA) and Singular Value Decomposition (SVD), methods previously introduced into meteorology and oceanography by Rudolf Preisendorfer. Although Mann described PCA as a new technique, it was originally developed in the early twentieth century by Karl Pearson, a “father” of modern statistics, biometrician, and eugenicist.¹² PCA resolves a set of possibly correlated data points—that is, observations that include factors which may overlap with each other—into a set of linearly uncorrelated orthogonal “principal components” by determining the “eigenvectors” of the correlation matrix.

In effect, PCA breaks data down into a set of vectors to reveal significant patterns: the first principal component will explain the most variation, since most of the data lies along its axis, the second the next, and so on. Most simply, PCA and eigenvector analysis in general recenter data around a new set of axes, which makes mathematical calculations much easier.

Mann et al. used PCA in two ways: first, they used PCA to “even out” the data spatially. Second, and more controversially, they used PCA to determine the most leading patterns of variation in their larger dataset. Each eigenvector they produced was resolved into both a spatial component—an “empirical orthogonal function” (EOF)—as well as a principal component over time. According to Mann, the first eigenvector describes eighty-eight percent of the variability in global mean temperature and seventy-three percent of the variation in the hemispheric mean temperature. It clearly shows a rise in mean temperature during the twentieth century. The subsequent eigenvectors reveal spatial variability: the second shows a modest La Niña-like cooling trend in the eastern tropical Pacific. EOFs explain variation in decreasing intensity, but nevertheless all still point to trends.

Mann et al. used twentieth-century data to determine these patterns of variation because all proxies were present during this time period. They then calibrated “each of the indicators in the multiproxy data against these empirical eigenvectors at annual-mean

resolution during the 1902–80 training period” using SVD, which helped produce reconstructed principal components over a longer historical time period.¹³ Each principal component was a weighted sum of some or all of the measured variables or proxies. The first principal component might, for instance, weigh one proxy by .5, and another by .25, so that each proxy is included relative to all the others. To verify these reconstructed principal components, they tested these predictions against actual data for the period before the twentieth century (hence the error bars above and below the hockey sticks). They also changed the number of proxies and eigenvectors used during different time periods, since not all proxies were available or pertinent for each eigenvector and time period. The reconstructions from 1820 onwards, for instance, used the full multiproxy network of 112 indicators and resolved eleven eigenvectors, whereas the period from 1820–1760 took ninety-three indicators and resolved at least nine eigenvectors. The number of available proxies and resolved eigenvectors diminished with each time period. Within the five most significant reconstructed principal components they uncovered, the first shows an increase in temperature over time, and the second shows a slight decrease in temperature, in line with its associated EOF. Through this analysis, they determined that the most important pattern was one of temperature increase in the Northern Hemisphere.

The attacks Mann received focused on his use of proxies. Willie Soon and Sallie Baliunas, two physicists based at the Harvard-Smithsonian Center for Astrophysics, argued that multiproxy networks such as those that are used for PCA were inherently inaccurate.¹⁴ They wrote that “the results from the proxy indicators cannot be combined into a hemispheric or global quantitative composite ... but should rather be considered as an ensemble of individual expert opinions.”¹⁵ That is, each individual proxy—each tree ring and ice core, for instance—should be given an equal voice. Given the overwhelming amount of the tree ring data from midlatitude areas, this would mean only being able to hear the many sets of tree ring data, which, not surprisingly, show global warming during the medieval period. This article, which was championed by politicians such as US Senator Jim Inofe, was shown to be riddled with errors and the peer review process that led to its publication deeply flawed. The chief editor of the journal *Climate Research* and critic of Mann’s research, Hans von Storch, and several other editors, resigned in protest over the editorial process.¹⁶

Mann was also attacked for his use of the shortened period (1902–1980) to calibrate principal components for the entire timespan of his inquiry. Canadian businessman Stephen McIntyre and social scientist Ross McKittrick reviewed Mann’s article and, in addition to finding several transcription errors in the data, alleged that

Mann's use of the shorter calibration period skewed the results so that any data fed would produce a hockey stick.¹⁷ They redid the analysis so that the entire period (1400–1998) was used, and found that the warming trend went from principal component one to four. They then only used the first two principal components—which they argued explained most of the variation in their reconstruction—and the warming effect disappeared. This article was published in the controversial journal *Energy & Environment*, and it garnered much attention, especially in the non-academic press. *The Wall Street Journal* featured an article on it and portrayed the businessman with backing from the petroleum industry as a David taking on Mann the Goliath, who was then an assistant professor at UVA.¹⁸ Yet this paper was also deeply flawed, with their difference in findings due to the fact that McIntyre and McKittrick removed two thirds of the proxy data Mann used for the fifteenth and sixteenth centuries.¹⁹

The criticisms of Mann's hockey stick were most effectively silenced by a 2006 report from the National Academy of Science and a report by physicist Richard Muller at UC Berkeley, a former climate change denier who was funded by the Koch brothers to revisit the hockey stick.²⁰ Muller had previously referred to McIntyre and McKittrick's work as a "bombshell" that revealed the bad science that fueled global climate change research. In his 2006 report, however, Muller used "real" data to reconstruct the mean temperature in the Northern Hemisphere and found it to be, in fact, much worse than Mann's diagram. Conceding the point without issuing a direct apology, Muller stated: "When we began our study, we felt that skeptics had raised legitimate issues, and we didn't know what we'd find. Our results turned out to be close to those published by prior groups. We think that means that those groups had truly been very careful in their work, despite their inability to convince some skeptics of that. They managed to avoid bias in their data selection, homogenization and other corrections."²¹ In contrast to the death threats and harassment Mann received, Muller won a prize from Foreign Policy for his about-face.

Mann not only used proxies to produce a proxy—the hockey stick—he himself became attacked as a proxy. A proxy, that is, for the alleged "bad science" that purportedly buttresses false evidence for global climate change. Explaining the harassment Dr. Benjamin D. Santer received for his work on the 1995 IPCC report, Mann calls the practice of isolating and making an example of an individual scientist the "Serengeti strategy," after the practice of predators on the Serengeti to pick off vulnerable individuals from the rest of the herd.²² These scientists are vilified not simply as individual bad scientists, but as representatives of the herd as a whole.

Embracing Proxy Politics

Mann attributes the ferocity of the attacks against the hockey stick to its “easy to understand” nature.²³ He writes: “the controversy that the hockey stick would ultimately generate, however, had little to do with the depicted temperature rise in and of itself. Rather, it was a result of the perceived threat this simple graph represented to those who are opposed to governmental regulations or other social restraints aimed at protecting our environment and the long-term prospects for the health of our planet.”²⁴ The power of the hockey stick stemmed from its simplicity and its easy duplication.

Mann has since embraced—rather than eschewed—images. Once pilloried via a cartoon YouTube video which falsely accused him of “hiding the decline,” Mann has partnered with cartoonist Tom Toles to produce an illustrated book about global climate change titled *The Madhouse Effect: How Climate Change Denial Is Threatening Our Planet, Destroying Our Politics, and Driving Us Crazy*.²⁵ Each chapter is prefaced by cartoons that satirize the arguments of deniers, point to the effects of the privatization of science, and illustrate the possibly catastrophic effects of global climate change. Rather than back away from politics or images, Mann has amplified and sharpened them.

Mann’s move towards images is important. Not only does it allow him to reach out to a more general audience in order to register both the reality of global climate change and the tactics of global climate change deniers, it makes clear the political engagements that must accompany any use of proxies. This lesson resonates far beyond global climate change studies: proxies are also central to Big Data analyses, and it is through proxies that many biases and assumptions are introduced.²⁶ Correlations are used to determine proxies. In statistics and economics, proxies correspond linearly; they associate with hidden or unknown variables. The proxy is literally a stand-in or a surrogate. According to the Oxford English Dictionary, the word “proxy” stems from the classical Latin term “procurator,” which means “manager, superintendent, agent, steward, financial administrator of a province, attorney,” but which became, in post-classical terms, “proctor in the ecclesiastical courts ... [and] university official.” Proxies were first human substitutes or agents, then payments given in lieu of services.²⁷ Proxies, though, seem less independent than agents: they are always tethered to their source; they’re not supposed to get a cut or go rogue. Over time, proxies became things that ensured direct and equivalent substitution.²⁸

Proxies are not innocent, but neither are they inherently guilty. By setting up a relation to the unknown or absent, they introduce uncertainty, even as they reduce it. Proxies are necessary *and*

inadequate; indeed, they point to inadequacies in direct knowledge. As Christoph Rosol has argued, paleoclimatology must use and negotiate proxies, which means that it troubles the boundary between data and model.²⁹ As Boaz Levin and Vera Tollman have argued, proxies are fundamentally ambivalent, and our current politics engages proxies at all levels.³⁰

The ambivalence of proxies must be emphasized.³¹ A proxy embodies what Jacques Derrida called a pharmakon: a supplement or intermediary “a philter, which acts as both remedy and poison.”³² Proxies absolve one of responsibility—a payment in lieu of hospitality—by creating new dependencies and relations. For proxies touch the unknown: they extend the archive, the knowable, by capturing or syncing to what is not there. Proxies spark controversy. Thus, we cannot know the types and valences of inquiry and mobilization that image-making processes will open up in advance. But this should not dissuade us from using proxies: we must if we are to create a more just and viable future. It is to call upon us to move beyond simply validating or vilifying proxies in global climate change and Big Data algorithms. It is not their mere existence, but their relations to the unknown, that matter.

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- 10 Michael E. Mann, *The Hockey Stick and the Climate Wars: Dispatches from the Front Lines* (New York: Columbia University Press, 2012), 45.
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- 13 Mann et al., “Global-scale temperature patterns and climate forcing over the past six centuries,” 781.
- 14 Willie Soon and Sallie Baliunas, “Proxy climatic and environmental changes of the past 1000 years,” *Climate Research* 23 (2003): 89–110.
- 15 Soon and Baliunas, 89.
- 16 Mann, *The Hockey Stick and the Climate Wars*, 120.
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- 20 Geoff Brumfiel, “Academy affirms hockey-stick graph,” *Nature* 441 (2006): 1032–1033; Richard A. Muller, “The Case Against Global-Warming Skepticism,” *The Wall Street Journal*, October 21, 2011.
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- 23 Mann, *The Hockey Stick and the Climate Wars*, xvii.
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- 25 Mann, *The Hockey Stick and the Climate Wars* (2012), xv; Michael Mann, *The Madhouse Effect: How Climate Change Denial Is Threatening Our Planet, Destroying Our Politics, and Driving Us Crazy* (New York: Columbia University Press, 2016).
- 26 As Cathy O’Neill has documented, zip codes—amongst many other proxies—are central to the operations of weapons of math destruction (WMDs). WMDs “draw statistical correlations between a person’s zip code or language patterns and her potential to pay back a loan or handle a job. These correlations are discriminatory, and some of them are illegal.” Cathy O’Neil, *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York: Crown, 2016), 17–18.
- 27 The term proxy is a synonym for agent, “a person who or thing which acts upon someone or something; one who or that which exerts power; the doer of an action,” Oxford English Dictionary, “agent.”
- 28 Proxies are “document[s] empowering a person to represent and act for another”; or, in the Christian Church, “an annual payment by incumbents... as a substitute for providing for or entertaining a visiting bishop or his representative.”
- 29 Christoph Rosol, “Data, Models and Earth History in Deep Convolution: Paleoclimate Simulations and their Epistemological Unrest,” *Berichte zur Wissenschaftsgeschichte* 40, no. 2 (June 2017): 120–139.
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- 31 Proxies are central to my forthcoming book, *Discriminating Data: Correlation, Neighborhoods, and the New Politics of Recognition* (Cambridge, MA: MIT Press, 2021).
- 32 Jacques Derrida, “Plato’s Pharmacy,” in *Dissemination*, trans B. Johnson (Chicago: Chicago University Press, 1981), 73.

Crystalline Basement

Hans Baumann
and Karen Pinkus

Geothermal heat is foundational to the planet Earth, but its distribution is uneven. In Iceland or along the “Ring of Fire” in the Pacific, heat lies at or near the Earth’s crust, where it is easily accessible and visible, part of the everyday landscape. In the spa town of Noboribetsu on the northern Japanese island of Hokkaido, one of these geothermal expressions is known as “*Jigokudani*” or “Hell Valley,” for its boiling black waters and barren, sulfur-encrusted rock crevices that excite the superstitious mind. Landscapes such as this are portals to an underworld of almost boundless energy production.¹ In other areas of the globe, heat lies much deeper down, and accessing its potential energy is both costly and uncertain. At Cornell University in Central New York State engineers and campus facilities managers are developing an experimental drill site where they are attempting to extract deep geothermal heat as a non-carbon energy source.² To do so, they must cut through thousands of meters of sedimentary rock to a threshold, around four kilometers down, known as the “crystalline basement.”

Few proponents of deep direct use (DDU) geothermal extraction imagine this technology as an in-kind replacement for fossil fuels.³ At present, geothermal does not generate electricity, nor can it be used for transportation—two sectors that add up to over half of the world’s currently energy use. Technically speaking, geothermal is neither a fuel, nor is it “renewable,” at least not in the scale of human time.⁴ Geothermal energy originates from two primary sources: decaying radioactive elements or, more commonly, from the billions-year-old interstellar, chaotic collisions that formed the planet earth. Once this heat energy dissipates, it is unrecoverable. Over millions of years and under certain geological conditions, even fossil fuels could well renew themselves, but such speculation is immaterial to the urgent necessity of energy transitions in the present. Given these limitations, geothermal boosterists normally imagine this primeval heat as part of a “portfolio” of “future fuels” that can collectively move us into a “sustainable,” post-carbon world. The term “portfolio,” widely used in the field of renewables, resonates with balanced investments that hedge against volatility and evokes the uncritical optimism found in the glossy brochures of your financial advisor. The rational Keynesianism of such discourse is comforting in the face of increasing environmental stochasticity, yet it avoids thinking of a radically alternative future. Non-carbon energy sources such as geothermal may indeed help us achieve carbon neutrality, but they do nothing to address the gigatons of carbon that have already accumulated in the atmosphere.

Funded by a Department of Energy grant, Cornell’s team of deep heat miners hope to generate power to help the campus meet its goal of carbon neutrality by 2035. No human laborers will descend down into the doomy interior, yet “mining” is not merely a

metaphor, here. The process, in its most basic sense, involves drilling and extraction, but where most traditional forms of mining bring up matter that can later be combusted, admired, alloyed with other matter, or sold, heat mining draws to the surface a commodifiable yet ephemeral product of deep time. The hot dry rock (HDR) of the crystalline basement is itself energy, instead of latent fuel material. While we may casually interchange “fuel” and “energy” in everyday speech, maintaining a rigorous distinction between matter (volatile, fluid, intractable, compressed, generous, and so on) and a system or structure into which it could be inserted opens up a way of thinking beyond the poles of anti-production (“leave it in the ground”) or pure exploitation (“drill, baby, drill”).⁵ Or beyond what one critic, describing Deleuze and Guattari’s “geophilosophy,” calls, “impasses of State-sanctioned resource exploitation and reactive environmentalism.”⁶

The Cornell borehole will be roughly fifteen centimeters in diameter and at least four kilometers deep. It will be unobtrusive, and if you lacked prior knowledge of this undertaking, you would pass by its construction site without a second thought. Even the mine tailings produced by this operation are diminutive, taking the form of silty rock dust that is incongruous within the massive scale of this endeavor. In other forms of drilling and in different locales, the small visual footprint of extractive facilities has become a common justification for the expansion of such operations. Advances in technology such as directional drilling direct the vast majority of disruption to the subterranean, where its deleterious effects (such as groundwater contamination) are difficult to assess and easy to conceal. As Republican Senator Lisa Murkowski of Alaska argued with regard to oil drilling in the Arctic National Wildlife Refuge (ANWR): “The effect is imperceptible on the surface. The caribou don’t know it’s there. People flying over don’t know it’s there. The technology has advanced so much, but people can’t let go of their old images.”⁷

Engineers at Cornell plan to sink their well as straight as possible, but the tubing that will line the hole can curve slightly, as necessary, to conform to the strata. Once the borehole reaches its target, heat miners will search for existing fractures in the hard, metamorphic gneiss of the bedrock. These fractures can be utilized as reservoirs in which cool water can be brought down from the surface, heated, and recirculated back up. Where naturally occurring fractures are absent, the crystalline basement can be broken apart via mechanical means. This rock likely dates from the Precambrian Era, which would make it among the oldest extant material on the planet Earth.⁸

There are potential side effects, as might be expected of any enterprise of this magnitude and nature. The mechanical process used to mine Ithaca’s geothermal heat is similar to that employed

in hydraulic fracturing, or “fracking.” The fracturing for geothermal energy infrastructure carries little risk of chemical contamination, but as with hydrocarbons, the technique can introduce the potential for seismic disruptions of varying intensity. Shrinkage, rock stresses, crustal cooling, and the release of localized heat waste might occur. No one knows exactly what to expect, or what the public tolerance for unnatural/natural occurrences will be. Deep geothermal systems introduced in Basel caused a series of minor seismic events throughout this Swiss city and canton in the late 2000s (most notably in 2006). These had little physical impact on the built environment, but unleashed a series of lawsuits and ensuing regulations that stalled geothermal projects throughout Europe and the United States.

Sensory Data

James Hutton has been called the father of “deep time,” or modern geological theory. The eighteenth-century doctor, investor, and man of considerable wealth spent a great deal of time wandering the Scottish countryside and looking at rock outcroppings. Two schools of thought prevailed about the formation of the earth at the time: Neptunism proposed that rocks formed during a period of crystallization in the oceans, whereas Plutonism upheld the volcanic origins of geological variation. The greatest defender of the former theory, Abraham Gottlob Werner, believed that sedimentary rock—the layers and strata—could only have been formed by water (even if he admitted that volcanoes might have a slight effect). His theory allowed for the possibility that Noah’s flood had simply repeated a process begun earlier in Earth’s history.

Hutton developed a radical and heterogeneous theory encompassing erosion, molten rocks cooling, sedimentation, continents rising and falling, and so on. Such processes could only occur over periods much longer than the six thousand odd years held to be compatible with Biblical time. Hutton sensed that heat was crucial:

One had only to ponder volcanoes and hot springs to sense that there was a great deal of heat within the earth—much exceeding what could ever have been produced by an odd seam of burning coal—and that not only could high heat soften up rock and change it into other forms of rock, it could apparently move whole regions of the crustal package and bend them and break them and elevate them far above the sea.⁹

After a boat trip to Siccar Point (near Hutton’s home of Edinburgh), his companion, John Playfair wrote: “We felt ourselves necessarily

carried back to the time when the schistus on which we stood was yet at the bottom of the sea, and when the sandstone before us was only beginning to be deposited... Revolutions still more remote appeared in the distance of this extraordinary perspective. The mind seemed to grow giddy by looking so far into the abyss of time.”¹⁰

We cannot ourselves travel to the crystalline basement to survey the lithoscape for openings in the rocks, to seek out fractures or determine where to point pumps for maximum efficiency. We cannot stand at some ideal distance from the mine and observe it, as if in a section cut, or in order to survey men working under and above ground simultaneously. The geological realm is largely unseen and escapes unmediated, unabstracted human experience. We develop artificial devices to probe strata and produce maps from the corresponding data. We employ graphic media like the vertical geological column that marks out epochs in distinct, colored bands. The representational technique of the cutaway, section, or “ant farm-view” prefers the z-axis, thus rendering the subsurface as mappable space, made of up vertically oriented layers that we can date and know, regularized and fixed—more multi-dimensional “*terrane*” than conventional “terrain.”¹¹

To read the section cut of a geological column, you normally begin at the bottom and move your eyes smoothly upwards toward the top, toward the present. The early Archean of the Precambrian is a narrow, brown mark. Abstract bands of colors aggregate on top, like layers building up around a tiny core until we reach the present, full earth. Because the geological column organizes itself through time and not space, our era—the Holocene, or Anthropocene depending upon your affiliation—finds itself at the top, the surface condition imparting a sense of primacy to our present. We know this is not true, but such is the logic of the model. Depending on the degree of speculation one wishes to indulge in, we can imagine a geological column from the distant future in which new strata have accumulated above our own. The bounded and discrete stacks of the column graphic are used to represent time and change, yet the fixity of the grand narrative described therein is so naturalized that we struggle to rid ourselves of its regularity. It disguises our entanglement with the subsurface and flattens out chaotic change of the type indicated by Deleuze and Guattari or Manuel de Landa: sorting, settling, subsidence, and other disruptive events. Our present cannot exist without the recovery and use of fossil fuels or the more ancient geological materials that, aggregated and re-formed, constitute the basis of our built environment. We become contemporaneous to crude oil, rare earth minerals, and the like through our engagement, extraction, and manipulation of these materials. They existed prior to humankind, they exist alongside us, and they will exist long after our extinction.

Philosophy will not assist in the technical process of heat mining, but Deleuze and Guattari respond to the broader implications of subsurface mastery and chaos/uncertainty. According to Dianne Chisholm:

[E]arth flows and forces give rise, on the one hand, to volatile, molecular haecceities (earthquakes, flash floods, tsunamis, stock exchange collapses, anarchic G8 demonstrations) and, on the other, to stable, molar assemblages (the Chinle formation, State flood canals and retaining sea-walls, the World Bank, the United Nations), that in turn, reterritorialize upon other, more stable assemblages (despotic infrastructure like the Three Gorges Dam, Federal Disaster Prevention and Relief Agencies, Transnational Corporations and Global Cartels), or yield to relative deterritorializations mobilized by less sedentary, more “nomadic” assemblages (portable or mobile “earth moves” architecture, anti-globalization coalitions, the Great Bear Rainforest alliance of ecological science, forest management, environmental activism, and aboriginal wisdom).¹²

The tension between stochasticity and stability is inherently geological. Slow forces aggregate massive change over countless millennia and the silence of this creeping timescale conveys stability. Earthquakes, landslides, and volcanic eruptions are massive, sudden, and transformative from the human vantage point, but from the geological perspective, these events are embedded within processes of a far greater magnitude. In the realm of the geological, epochs of incomparable complexity are compressed and layered like homogenous plastic blocks until—billions of years after their formation—they are subducted and cannibalized by the earth’s molten core. The relative simplicity of geological materials all but erases the abiotic chaos that led to their creation: swirling dust, alien meteorites, pounding lifeless seas, super continents, mega volcanoes and so on.

Narrative

In the early 1970s, Robert Smithson published *Strata, A Geophotographic Fiction* in the art journal *Aspen*. Under panoramic photographs of rock strata are lines of text that include full sentences, lists of materials, and free associations. The content of the strata in this piece do not correspond to events of the actual geological epochs listed on the left-hand side, lending Smithson’s work an apparent lack of technical rigor. In *Strata*, Smithson is more

interested in aggregation and form than in scientific accuracy. By virtue of its layout, *Strata* reads like a narrative text, from left to right, from top to bottom, or in geo-graphical terms, from present to past. By intentionally subverting scientific convention, Smithson suggests that the subterranean and the geological are a projective domain. The “geophotographic fiction” of *Strata* draws into question the extent to which the subsurface can be mapped, visualized, and known. Much of Smithson’s work intervened upon extraction sites, and *Strata* indicates the boundaries necessitated by any system of exploitation, especially those associated with the below-ground. Here, materials, organisms, and narratives are known only insofar as they have value as commodities. There is no need to visualize that which lacks market value.

“Raise your mind above the base mercantile and utilitarian needs of commerce... Let the knowledge lead us where it will, we still must seek it.” These words are spoken by Professor Challenger in Arthur Conan Doyle’s story, “When the World Screamed” (1928). Deleuze and Guattari laud Challenger—a recurring character throughout Doyle’s oeuvre—for his unique understanding of the Earth as “deterritorialized,” a body without organs that is “permeated by unformed, unstable matters, by flows in all directions, by free intensities or nomadic singularities, by mad or transitory particles.”¹³ For the French thinkers, Challenger stands, essentially, against strata that “consist in giving form to matters, of imprisoning intensities or locking singularities into systems of resonance and redundancy... Strata are acts of capture... They operate by coding and territorialization upon the earth.”¹⁴

Challenger bores a hole on land he owns, in Sussex. He pretends that he intends to drill down for oil, but it’s just an alibi. He boasts that he has managed to dig farther than anyone has ever dug before, in an experiment greater than anyone has ever attempted. At first, that’s all he reveals. His hole is large enough to accommodate those baskets that convey workers down to the active seams in coal mines. The narrator is one of those engineers that Challenger needs to complete his plan, but whom he despises for their practical knowledge and lack of virtue. So down goes the narrator:

Since the cage was latticed and brightly illuminated, we had a clear view of the strata which we passed. I was conscious of each of them as we flashed past. There were the sallow lower chalk, the coffee-coloured Hastings beds, the lighter Ashburnham beds, the dark carboniferous clays, and then, gleaming in the electric light, band after band of jetblack, sparkling coal alternating with the rings of clay. Here and there brickwork had been inserted, but as a rule the shaft was self-supported, and one could but marvel at the immense

labour and mechanical skill which it represented. Beneath the coal-beds I was conscious of jumbled strata of a concrete-like appearance, and then we shot down into the primitive granite, where the quartz crystals gleamed and twinkled as if the dark walls were sown with the dust of diamonds. Down we went and ever down—lower now than ever mortals had ever before penetrated.¹⁵

Recall that Challenger has no interest in extracting anything. With the help of the narrator, he reaches the core, alive with uncolonized, ungovernable, and un-nameable forms of gooey, oozing life. The feminine, abject earth responds to his presence, not through language but with a massive disruptive explosion felt all around the world. Challenger is a heroic anti-hero. When they invoke him in “10,000 B.C.: The Geology of Morals (Who Does The Earth Think It Is?),” Deleuze and Guattari are not performing a reading of a particular text. They are themselves mining a series of texts, like Smithson does in *Strata*, placing proper names, figures, and lines of dialogue into a great geological shifter where they may end up deformed and next to others. They are writing under the pressure and nonlinear chaos of deep time.

Diamond-studded drill bits chew through billions of years of earth’s history. Engineers pump fluids down into the dense bedrock of the crystalline basement, yet this material can’t be expected to respond to our prodding in the fashion that the earth’s oozing feminine core did to Challenger. There is no cataclysmic rupture, only liquids silently returning to the surface where—unseen—they warm offices, hallways, and classrooms. It is a mundane endpoint for a system of such highly engineered complexity, yet these industrial operations are capable of generating far more than the engineering plans and unstudied enthusiasm that accompany them.

As both Challenger and Smithson suggest, the act of drilling is a form of inquiry and a means of engaging with the compressed, simplified order of geological strata. Geothermal heat mining operations like the one planned in Ithaca may be utilitarian in nature, yet these boreholes transit billions of years of embodied energy and act as a conduit for heat from the very origins of this planet. They encounter the material fragments of the unfathomably complex historical narrative, so grand in scale that it becomes abstracted and can be probed but never fully assembled. Absent of the need to secure physical fuel materials, mining becomes a nonrepresentational and nonvisual mode of interfacing with the subterranean; it becomes a collision of improbable narratives via differential material accumulations.

Just as we might stare at the geological column and imagine our place in the future fossil record, we might also begin to align ourselves with the deep geological past that our speculative

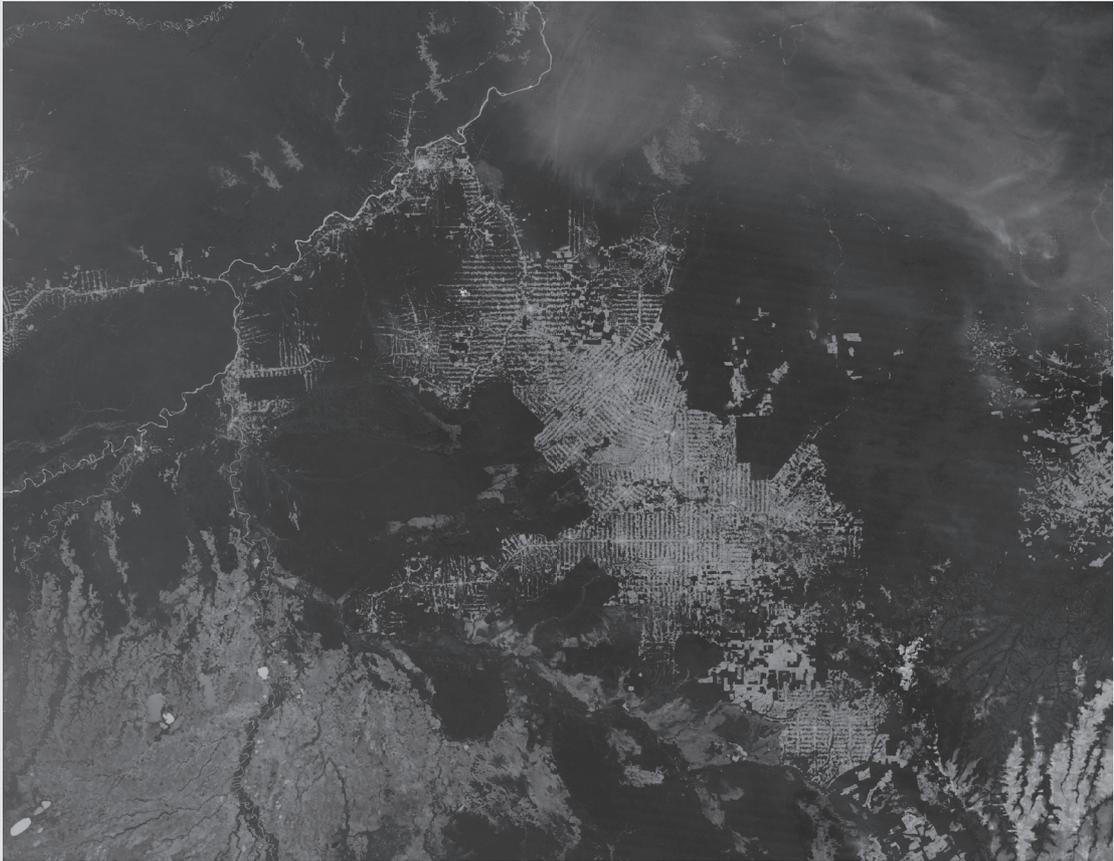
boreholes encounter. Doing so requires us to engage with the tenuousness of our historical position: namely, that humans are carbon-based life forms and stochasticity will entomb us. The geological realm collapses all potential for resistance. From this perspective, human primacy is a construct to be shaken away at will by earth forces. Scientific rationalization is stripped of its epistemological privilege and only humanistic narrative persists. Geothermal energy may indeed help us achieve carbon neutrality and “save” the world as we know it, but it is more likely that we have waited far too long to address the climate crisis in any meaningful capacity. Four kilometers below the earth in Ithaca, the hot dry rocks of the crystalline basement wait in silence, patiently, for first contact.

- 1 Millions of tourists flock to Yellowstone to see Old Faithful and other geysers perform plutonic spectacles. Landscapes such as these appear like portals to an underworld of apparently limitless energy. As potential sites for geothermal exploitation, they also open up debates about aesthetics and the preservation of traditional habitats. Some Hawaiians argued against the geothermal power plant at Kilauea, recently shut in the wake of the volcano’s eruption, on the grounds that it “not only subverts their worship of the volcano goddess Pele, but also that the drilling itself saps her spirit.” Shannon Hall, “Yellowstone Supervolcano Could Be an Energy Source. But Should It?,” *National Geographic*, August 8, 2018.
- 2 To give just one example of such work underway, at Otaniemi, in the petrostate of Finland, the Scandinavian energy company ST1 plans to excavate a borehole over six kilometers deep. The project engineers draw graphs and images to represent depth, fractures, and so on, getting as close as possible through modeling to an actual experience of what will happen after they pass through the cold “snowflake crust.”
- 3 On energy units and uneven distribution H. Christopher H. Armstead and Jefferson W. Tester write: “Though in terms of heat units the energy storied in the earth’s crust is clearly gigantic, it must be recognized that it could never entirely displace liquid, gaseous, and solid fossil fuels.” They also note: “as with all the other resources of the earth, it cannot be expected that the rich potentialities of HDR [hot dry rock] are in any way ‘fairly’ distributed among nations.” H. Christopher H. Armstead and Jefferson W. Tester, *Heat Mining: A New Source of Energy* (London and New York: E. & F.N. Spon, 1987), 52.
- 4 To be commercially viable, the wells should produce heat for thirty to fifty years, according to current plans in Ithaca. In this sense, geothermal is certainly “transitional.”
- 5 In *Fuel: A Speculative Dictionary*, Karen Pinkus argues for this crucial distinction between fuel and energy. Karen Pinkus, *Fuel: A Speculative Dictionary* (Minneapolis: University of Minnesota Press, 2016).
- 6 Dianne Chisholm, “Rhizome, Ecology, Geophilosophy (A Map to This Issue),” *Rhizomes* 15 (Winter 2007), 5.

- 7 Quoted in Bob Reiss, "Stalking an Elusive Prize in Alaska," *Fortune* (September 15, 2017): 144-153, 151.
- 8 Although the Precambrian had been defined by geologists as a time "before life," more recently some obscure forms of fossils and other traces have been detected, hence the latest of the three periods is sometimes called the Cryptozoic—for hidden life.
- 9 John McPhee, *Annals of the Former World* (New York: Farrar, Straus and Giroux, 1998), 73.
- 10 Cited in McPhee, 78–79.
- 11 "Terrane" is a term used by some geologists to refer to a swathe of land along both horizontal and vertical axes, present and past. In this regard it is much more ample and flexible than "terrain" and its indeterminacy suits our project well. But we want to be cautious about allowing "terrane," or, say, the figure of the geological column with different color bands of different depths representing different eras, to stand as something regularized or fixed because this can also lead to a discourse of control. Geologist and writer John McPhee resisted the term earlier in his career but eventually came to use it. He explains: "geologists use 'terrain' when they mean topography and 'terrane' when they are referring to a piece of country many miles deep." McPhee, 10.
- 12 Chisholm, "Rhizome, Ecology, Geophilosophy (A Map to This Issue)," 5.
- 13 Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (London and New York: Continuum, 1987), 45.
- 14 Deleuze and Guattari, 45.
- 15 Sir Arthur Conan Doyle, "When the World Screamed," *Liberty* (1928).

Becoming Planetary

Jennifer Gabrys



The globe is on our computers. No one lives there.
—Gayatri Chakravorty Spivak¹

Being human is a praxis.
—Sylvia Wynter²

Multiple images stare out from between the lines of this text. They tell planetary stories. They are also forest stories. Through remote sensing, one image captures the accelerating decline and loss of forests in the Amazon. This time-lapse image produced by NASA begins in 2000 with an intact patch of forest green in Rondônia, Brazil. Over the course of twelve years, roads and settlements encroach upon and fragment the forest into corridors and swathes of brown terrain. By 2012, this same forest section had been turned into a pockmarked landscape, the work of extraction evident through the steady consumption of forest-as-resource.³ Another image switches from remote sensing to LIDAR scanning of the Black Forest in Germany. Forests are being lost, as the remote-sensing images indicate, yet they are also changing in structure and, in some cases, losing their ability to store carbon.⁴ With ongoing resource and capital accumulation, the capacity for forests to accumulate carbon is diminishing. Yet another image shifts from these monitoring-based documents of forest decline to protestors occupying tree canopies in an attempt to halt their decline and destruction. Cables and wires secure figures in midair, attached to trunks, suspended in the thick of trees and impending logging activity. A final image moves from mass resistors protesting the construction of the Newbury Bypass in the UK to Palawan tribes harvesting honey from hives in ginuqu trees in the Philippines, where for over a decade mining activity has threatened forests and forest-based ways of life. Here are forest people, subjects made with and through forest practices. Each of these images suggests ways in which to figure and reconfigure human-planetary relations.

The forest, carbon, and media imaginaries that are captured in these different images tell different stories that span the remote, the durational, the extractive, the accumulative, the inhabited, and the contested. Forest media differently signal the configuration of the planetary and planetary subjects. Images such as these are increasingly common, charting the loss of forests as carbon sinks, the accumulation of heat leading to climate change, and the human subjects who are variously constituted along with these shifting environments. The planet transitions from forest to development, and remote and ubiquitous sensing technologies monitor, log, and display these changing conditions, as humans enter the frame as a diverse array of earthlings, from remote scientists to protestors or precapitalist figures. With over four billion

hectares of forest worldwide, these forests and their inhabitants are increasingly captured through monitoring and sensing media that seemingly provide a more planetary understanding of forests as systems. Yet these images also lead one to ask: In what ways does the planetary become evident, whether as object, process, or event? How is the planetary configured, rather than assumed and given? Is it only at the most zoomed-out scale of remote sensing, or through the LIDAR scanning of forests? Is the planetary evident in the temporal processes that endure over time and register through the composition of a forest, or through the occupation of a forest canopy or treetop?

It is now not uncommon for the planetary to be invoked in discussions of technology. Technology—especially computational technology—is analyzed as something on the “scale” of the planetary. Technology is seen to overrun and command the planetary. The planetary is discussed as a figure of massiveness. Its invocation suggests total dominion: the rolling out of behemoth systems that hold the planet and all its entities in a space of complete capture. This total view of earth has an even longer history within modes of control and colonialism. As Elizabeth DeLoughrey writes, “modern ways of imagining the earth as a totality, including those spaces claimed for militarism and globalization, derive from colonial histories of spatial enclosure.”⁵ While the total view might, on the one hand, suggest a mode of globality aligned with coloniality, on the other, it also suggests a mode of technology that is similarly aligned with colonial projects. The detached and distant view of earth produces an entity that could seemingly be managed—or programmed. This total view of the planet suggests complete interconnectedness, but also forms of imperial control. It is the product of globality as well as universal science. A total view can even seem to be necessary: as a way to organize the problem of climate change, for instance, in order to act upon it. Climate change is an event that comes into view through planetary computation, where global infrastructures make it knowable.⁶ Yet in what ways do these modalities of the planetary reduce the possibilities of what the planetary is or might become—of being planetary as praxis? How might it be possible not to remake the pretensions of globality and globalization through planetary media projects, but rather begin to unsettle figures of totality and regulation in order to attend to the incommensurate, the unjust, and the yet to be recognized?

These questions point toward other readings of the planetary and of praxis informed by the works of theorists Gayatri Chakravorty Spivak and Sylvia Wynter. In asking what other figures or modalities of the planetary might be operationalized beyond those of the planetary-scale, we can take lead from the multiple

deliberations on the planetary developed by Spivak, who in working with and reconstellating this term sought to open the planetary toward other (collective) inhabitations.⁷ In a different, yet resonant way, Wynter's work indicates how the problem of the raced human is inextricably tied to planetary problems. The "catastrophe" of climate change is also a "catastrophe" of the ways in which the "genre" of the human has been designated as an excluding and accumulating subject. Yet this mode or way of being human, as one limited genre, might also be questioned and transformed. She suggests a project that attends to *being human as praxis* as a way to engage with the processes that sustain—and that might also remake—ways of being human.⁸

Reading across these concepts of the planetary along with ideas for transformed and praxis-based approaches to the genres of being human, these thinkers and practitioners present other ways of encountering planetary problems by rethinking planetary subjects and humans that attempt to undo present catastrophic modes of accumulation. The question of the planetary cannot be addressed without also reworking divisions of the human, and the injustices that result from these limited modes of being. At the same time, by attending to the planetary it is possible to consider how the prevailing genre of the human has excluded more-than-human entities and relations. This proposal for a project of being planetary as praxis suggests that it might be possible to rework the usual approaches to humans and environments, as well as to propose new conditions for planetary media.

The forest images included here are then less representational and more operational.⁹ Neither a worm's-eye view nor a bird's-eye view, they ask that one begin from within the thick of planetary inhabitations, in the forests as they are lost and potentially remade, and as they reconfigure relations across people, more-than-humans, technologies, politics, and the planetary. How does this gaze from *within* planetary inhabitations generate multiple modes of praxis? The ways in which climate change registers in forests can be read at once as a medial event, a planetary event, as well as an event implicating humans (of multiple designations). Forests are planetary media that register and operationalize collective accumulations of carbon and heat: they are proxies that record and register the effects of climate change.¹⁰ At the same time, forests involve multiple inhabitations, protests, and struggles for ways of being in the world. These images, as well as forests, are forms of planetary media. They indicate ways of being planetary as praxis.

Being Planetary as Praxis

“The globe is on our computers.” In this statement Spivak suggests that the globe is contained by our exchanges, representations, and computations of it. The planetary can be a different figure for undoing the totality of globes and globality. Rather than bringing the earth into view as a total object, as is often discussed through the figure of *Earthrise* (1968), the planetary remains that which cannot be fixed or settled. The planetary resists representation. In Spivak’s development of the concept of the planetary, the point is not to generate an evasive figure, but rather to thwart an engagement with the planetary that hinges on uniform epistemic representations. The planetary is not a ground or grounding. Instead, it signals toward an “inexhaustible diversity of epistemes.”¹¹ The planetary demands a mode of inhabiting with what escapes translation or “acceptance.”¹² It does not definitively come into being as globes or postcard pictures of floating blue marbles.¹³ The planetary is the difference, distance, and duration with, within, and against which it might be possible to think differently about being human and becoming collective. The planet might even “overwrite the globe” to undo the assumed uniformity of global systems and exchanges. What planet is this? And what happens to computers when the globe inside is overwritten by the planetary, which computers cannot contain?

The planetary is a concept Spivak has worked and reworked, with her initial discussion of the planetary presented as a lecture on migration in Switzerland in 1997 as “Imperatives to Re-imagine the Planet.” She expanded and developed her notions of the planetary and planetarity in numerous contexts, including her *Death of the Discipline* study of comparative literature written in 2003, where she takes a more psychoanalytic approach to the notion of planetarity.¹⁴ She subsequently extends this concept in multiple places, including in a “planetarity” contribution to the *Welt* (world) entry in the *Dictionary of Untranslatables*.¹⁵ This is a concept that Spivak has written and rewritten, forged and revised. It is in her earlier 1997 discussion though that she draws attention to the planetary as a way of figuring the subject and “collective responsibility.”¹⁶

The imperative that Spivak sets out in her 1997 text is one of *re-imagining* the planet. This re-imagining might be read as a speculative condition that encounters the planetary beyond the abstractions of the globe and globalism. It also refigures what humans are through considering how subjects form through conditions and even rights to collective responsibility. Spivak’s articulation of this concept was formed specifically within the context of considering how to “think the migrant” in Switzerland, when immigration was occurring from beyond Europe.¹⁷ The planetary in this sense is not proposed as an abstract figure of earth science,

nor is it a unifying globe that would make uniform and universal conditions for all humans. Instead, the planetary is in many ways irresolvable, and yet it is a way to figure, de-figure, and re-figure collective responsibility to the other in postcolonial and decolonial circumstances.¹⁸

The planetary at once reworks designations of the migrant beyond the nation-state, but also gives rise to a set of considerations for how a “practical dialogics” might keep in play multiple modes of human inhabitation without having to resolve or synthesize these, or to render them within a relation of domination or subjugation.¹⁹ This is another way of parsing subjects and communities through reference to the planetary. With this in mind, Spivak proposes: “Let me then modify my title: I speak of an imperative to re-imagine the subject as planetary.”²⁰ By re-imagining the planetary, the subject is also re-imagined. In other words, the designation of planet has consequences for the designations of subjects and communities. Far from a total force, absolute ground, or artifact of natural science, the planetary is more of an indeterminate condition and set of relations that sparks new encounters with collective inhabitations that do not turn into “multicultural liberalism,” or into the usual designations of environmentalism. Both the universal subject and the globe are undone in this planetary proposal.

This re-imagining of the subject is taken up in a different yet resonant register in the work of Wynter. For Wynter, the human as a category is formed through exclusions, especially on the basis of race. Wynter’s approach involves finding ways to do the human otherwise. Her work is an erudite reworking of the human toward other genres of being human, not as a definitional practice, but as a mode of praxis. This praxis has consequences for potentially undoing how people are raced, classed, sexed, and subjugated to be outside of the universal category of the human. “Being human as praxis” is thus Wynter’s proposal for how to expand the genres of the human to take account of and transform the racial and economic injustices and exclusions that are propagated through the current genre of the human. This praxis also experiments with other ways of being human in order to pluralize and diversify possibilities for being human—and by extension—for being planetary. Indeed, this is the point at which the planetary might be mobilized as praxis.²¹

By putting Spivak into dialogue with Wynter, it is possible to recast both the figure of the planetary, and the “genre of the human,” as Wynter has termed it. Planetary life and the figure(s) of the human are intimately connected. Indeed, as Wynter has convincingly demonstrated, the current version of the human that dominates modern life is not only based on a white Western privileged subject that is racially excluding; it also is an *accumulative* mode of the human as *homo economicus*.²² What has been rationalized

and naturalized is a reductive figure of the human that is based on ongoing accumulation. Those people who do not figure as accumulators do not fit within the prevailing genre of the human. Indeed, those others who are outside the category of human might be extracted from, subjugated, dispossessed, or exploited in order to enable the accumulation of categorical humans. Furthermore, this mode of the human-as-accumulator leads to multiple exclusions and reductions in the possibilities for other ways of being human. *Homo economicus*—human as accumulator—is a figure of planetary destruction, since the crisis of climate change can on one level be characterized as a crisis of accumulation—not just of carbon and heat in the atmosphere and biosphere, but also as an accumulative mode of the human that is forever consuming and bound to economic growth. The split and designation of this particular category of human is then not just a matter of racial and social justice—how these humans are designated, and who does and does not belong to the Western bourgeois delineation of the human—but it is also a matter of planetary survival. The genre of the human must be expanded so that other less destructive modes of being human—and being planetary—might be formed.²³

Wynter's discussion indicates how we might find ways to do the planetary otherwise. If the subject or human were here to become planetary, following Spivak along with Wynter, the universal designations of human and planet would be re-made and re-imagined. If Wynter proposes *being human as praxis* as a way to rework the possibilities for opening the category of the human, *being planetary as praxis* is a way to engage with the planetary-human that might also be re-imagined.²⁴ We are planetary creatures, Spivak suggests, but this is not a fixed designation, as Wynter's work further indicates. The sutures of difference that run through and across planetary creatures are also potential lines of praxis, giving rise to alternative configurations of "planetary thought" and planetary being and becoming.

The split into a particular category of human also involves, as Marisol de la Cadena suggests, a partitioning into universal nature and universal humans that depends on keeping these categories separate. Partitioning is not just a way of designating the planetary and the human. It is also a way of operating on the relations and segregations of each, such that ways of turning "nature" into "resource" and humans into accumulators might also occur. De la Cadena tells these stories through people's struggles to resist development, to struggle against the conversion of their relations with more-than-human entities into "resources." And yet, as she writes, "The interruption of the universal partition is a political and conceptual worlding event; what emerges through it is not a 'mix' of nature and human. Being composed as humans *with* nature—if

we maintain these categories of being—makes each more. Entities emerge as materially specific to (and with!) the relation that inherently connects them.”²⁵ De la Cadena reminds the reader that the categorization of the human is not just one of making sub-humans; it is also one of carving off other more-than-human entities into categories such as resources. Writing across Wynter, Spivak, and de la Cadena, one could say that separating humans by race, and designating the planetary as a globe or more-than-humans as resources also involves separating humans from worlds that spark them into (other) ways of being. Being planetary as praxis, in this way, involves working from within the forests, thinking through and working toward modes of being neither from a ground or grounding, nor from above in a position of mastery or partitioning, but from within the middle of asymmetrical yet non-subjugating planetary relations.

In the current context, this might also mean that characterizations of the problem of climate change could be recast. At the time of Spivak’s writing, the planetary was a way to address the question of migration within Europe as one of collective responsibility. This question still continues, and is now combined with forced migration through climate change. In a not dissimilar way, climate change then raises related questions about what collective responsibility as right, and about what mode of being planetary as praxis, might emerge here. The work of these thinkers signals toward ways not just of expanding and remaking the genres of the human, but also to ways of reworking and transforming human-planetary relations. The forest is a crucial figure and space within which these relations could be rethought, since it at once resists a universal and singular view, while also bringing into focus a multiplicity of subjects and inhabitations. Parsing the human is also a practice of parsing the planet and planetary relations. Projects of addressing racial injustice and inequity might then also be ones that remake planetary inhabitations, and vice versa. This could “unsettle” colonial ways of being as part of the operation of working toward less destructive inhabitations.²⁶ How might this approach to the planetary and to being planetary as praxis then inform the ways in which that “unparalleled catastrophe for our species,” the event of climate change, is addressed?

Hothouse Earth, Hothouse Planetarity

In the summer of 2018, heat waves occurred in multiple locations, from the High Arctic to southern Spain. Temperatures reached forty-six degrees Celsius in Portugal and wildfires tore through Attica in Greece and northern Sweden. One scientific study published during this time suggested that the planet might become “Hothouse Earth,” meaning that rising carbon emissions and

temperatures force the crossing of thresholds triggering nonlinear responses and feedbacks so that methane begins to release from permafrost, forests cease to be carbon sinks and instead begin to be a net source of carbon, and oceans begin to acidify while absorbing less carbon and contributing humidity to atmospheres and energy to storms.²⁷ Rather than operating in a relatively “stable” way with “self-reinforcing feedbacks,” ecosystems could amplify warming and irrevocably transform ecosystems—even to conditions that are inhospitable to human life—and in the process rapidly accelerate the process of climate change. Although the story of climate forcings, thresholds, and tipping points is not especially new, the article served as a reminder, in the midst of sweltering temperatures, forest fires, and flash floods, that planetary warming might kick into overdrive, making any current or near-future attempts at lowering emissions by marginal amounts an insufficient exercise.

While much of the focus within news media reporting on this article centered on the figure of the “Hothouse Earth” and its alarming rendering of a combusting planet, a less-reported aspect of the article pertains to the authors’ suggestion for ways to combat the scenario of a runaway warming planet. In order to prevent the possibility of “irreversible” climate change “driven by intrinsic biogeophysical feedbacks,” the authors suggest a pathway that could lead to a “Stabilized Earth” that could be achieved through “human-created feedbacks to a quasi-stable, human-maintained basin of attraction.”²⁸ The authors suggest that “stewardship of the entire Earth System” would need to be addressed, including of the “biosphere, climate, and societies.” Examples of these earth-sized actions that might move along to a stabilized state include not just using less fossil-fuel intensive modes of energy, but also developing new technologies, governance, and social codes. At the same time, planetary sinks might be cultivated to better store carbon. Forests become a project for human stewards. Geoengineering is also part of the mix, where “solar radiation management” could constitute part of the “stewardship” set of practices.²⁹ “Hothouse Earth” thus becomes a medial project: it makes the planet into a medium of stabilized operation and control.

The planet, as the earth sciences often remind us, consists of interconnected yet unpredictable systems. Planetary forces might easily cross a threshold toward other less livable conditions. This is not the self-correcting planet put forward in Gaia theory, but is rather one where accumulation runs amok. Carbon and heat do not just accumulate; they also amplify changes to the climate that differently shape conditions of planetary distress. Yet the planetary is ideally projected to be a figure of stability and control. The curious “basin of attraction” that humans might cultivate raises numerous questions about how “Hothouse Earth” might be addressed.

What humans, or genres of being human, as Wynter would term it, are these? Specific practices of “stewardship” proposed potentially include technocrats involved in geoengineering, forest workers reforesting continents, as well as speculative figures yet to be created for their planetary maintenance skills. It is equally unclear what sort of planet this might be, which would yield to a process of stabilization, veering away from “Hothouse Earth” to “Stabilized Earth” through the guiding practices of humans. Indeed, the end of “human civilization” is one aspect of climate change that scientists often designate as a likely outcome in their scenarios. Yet what does the planet have to become such that human civilization in this rendering might be sustained, however problematic that civilization might be? And what other planet-human configurations might be proposed such that human “civilization” is not a project of stabilizing the planet, but rather of re-imagining the human and the planetary as praxis?

“Hothouse Earth” then gives way to a “Hothouse Planetarity.” The usual forms of environmental science and environmentalism turn up here as conducted through the categories of universal science and the universal human-as-steward. Yet as Spivak writes, “to talk planet-talk by way of an unexamined environmentalism, referring to an undivided ‘natural’ space rather than a differentiated political space, can work in the interest of this globalization in the mode of the abstract as such.”³⁰ The globe that is on our computers—and in a basin of attraction—is one that can seemingly be controlled by universal humans. Even if the “natural space” of climate science is one largely impacted by anthropogenic activities, here the proposal for how to address “Hothouse Earth” does not differentiate how such stewardship activities would unfold across diverse locations and by multiple contributors. For instance, humans are much more likely to become climate migrants in the Global South, and potentially less able to contribute to forest stewardship or geoengineering projects, for better or worse.³¹ Indeed, science here remains within a universal and even “silent” modality, as Wynter would term it, by not engaging with the cultural practices and stories that code and recode ways of being human.³² Yet the problem of climate change forces a reconsideration of how new subjects, new humans, and new planetary relations are irrupting, even within proposals by climate scientists. “Hothouse Earth” proposes that a legion of eco-stewards emerge who would continually look after the planet to keep it in a stable state. Yet “Hothouse Planetarity” asks questions about which humans—and which genres of the human and the planetary—are enrolled here. Questions of social justice cannot be separated from problems of deforestation, biodiversity loss, rising temperatures, and environmental pollution. Planetary inhabitations are entangled with ways of being planetary as praxis.

To know the planet can be a way to fix it as a figure of analysis and management. Stability could even be seen to be a way to rid the planet of alterity: to make it knowable and so manageable within a universal science. It can be a way to elide planetary differences both within and throughout terrestrial inhabitations. Indeed, as the overall “Welt” entry to the *Dictionary of Untranslatables* charts, to *know* the world (here a different but useful concept to call into play when discussing the planetary) can be a much different relation than to *have* world.³³ This having of world is less a condition of possession, and more a mode of experience and engagement. Where we are in the world and the world is in us, as Whitehead would term it.³⁴ The planetary involves remaking environmental relations *and* remaking the subject-superject. If the planetary is a site of difference, it also constitutes and runs through subjects in diverse ways. If Spivak’s considerations of the planetary and planetarity are brought to bear, where the usual forms of environmentalism and custodianship are suspended, and yet the right to (collective) responsibility is held in play, then how might a “Hothouse Planetarity” unfold as a necessary rejoinder to the figure of the “Hothouse Earth”?

Planetary Media: Out of the Planetarium

This immense wooing of the cosmos was enacted for the first time on a planetary scale, that is, in the spirit of technology.
—Walter Benjamin³⁵

While Benjamin wrote “To the Planetarium” as a way to capture the wartime effects of planetary-scale technology, becoming planetary and being planetary as praxis would suggest a move “out of the planetarium” as a way to disassemble the universal figurations of the planetary scale and universal science. By moving out of the planetarium of the total earth and planetary-scale talk, one might also venture into the forest to find oneself in the thick of a set of planetary relations that are not easily fixed or figured, but which in their incommensurability signal toward other ways of being planetary as praxis. Being planetary as praxis is a move out of the planetarium to consider other designations and mobilizations of the planetary, the human, and techno-cultural practices. In this sense, media are neither planetary in scale, nor should they be figured through a universal computational or earth science imaginary. Instead, along with Spivak and Wynter, the planetary should be unsettled, along with media and the human. However, this unsettling does not arrive at an elemental materialism at the core of media, and it does not suggest a command-and-control stratum of technology permeating the globe. Instead, the planetary

is an ongoing process of creating, articulating, and transforming human subjects and collective inhabitations.

The globe is on our computers, but the planetary forces a diverse and sprawling set of encounters with media, technology, and science that might remake these practices. The *becoming planetary of media* is a concept that addresses the ways in which the planet and environments are figured as medial projects.³⁶ The planetary within discussions of media and technology has at times taken on an elemental or epic quality. In a not dissimilar way, environmental science often casts the planet as mix of large-scale atmospheric, oceanic, terrestrial, and biotic systems and media as elemental records. And yet, planetary media might necessarily involve an unsettling of these categorizations of the planet or media, since planetary media would neither be universally designated nor abstractly partitioned. To refer to planetary media is to call attention to the differences that planetarity invokes, to the inassimilable and incommensurate conditions of planetary inhabitation that cannot and do not settle into one coherent or planar object: not the earth of earth sciences, the globe of capitalism, or the human of *homo economicus*. The becoming planetary of media forces a recasting of the usual ways in which the planetary and media might be understood or approached. In this space the becoming planetary of media might unfold not so much as a tale of elemental media, but rather more as collective narratives that generate lived storylines toward more just worlds for diverse humans, more-than-humans, and their planetary inhabitations.

Being planetary as praxis and the becoming planetary of media thus asks how the planetary might provoke another way of figuring planetary inhabitations—of moving out of the planetarium and into the forest. Being planetary as praxis involves an attention to questions of colonial imaginations and control, of racial and economic exclusions, of environmental injustices, and of universal science and global abstractions that might be de-figured, superseded, and transformed in the search for more open and just ways of being human *and planetary* that are still to be re-imagined. The planetary is necessarily transfigured when re-considered beyond the partitions of universal science and global capitalism. The ways in which the planetary is constituted, informed, and even de-figured have consequences for planetary crises such as climate change, as well as proposals for addressing these crises through projects such as cultivating forests as carbon sinks. This approach to the planetary involves not just an abstract or totalizing set of planetary forces, but rather involves very distinct and unequal ways in which planetary politics, relations, and technicities unfold. This transfiguration reworks the planetary away from abstract globes and toward different genres of humans and collective responsibility. Planetary

media in this context are less categories of elements and resources and more a constitution and re-constellation of collective responsibility through a planetary imperative. At the same time, it is not a human designation of the planet, but rather an unsettling of the ways in which subjects are partitioned and formed, against universal and colonial figurations.

This approach moves away from the satellite view or the much-referenced images of Earthrise or Blue Marble and toward the more entangled environs of a forest. While this view does not offer up an absolute expanse, fixed figure, or even foundational elementalism as the basis for knowledge, it does remake planetary-subject relations. Forests become planetary media. They are proxies for climate change—they tell stories about the accumulation of carbon and the shifts in environmental conditions. At the same time, diverse forest inhabitations also offer another way of figuring the human-planetary genres and praxes that move away from globes, universal man, accumulators or subjugators, to engage with the practices that irrupt through the prospect of becoming planetary and being planetary as praxis. More-than-human contributors, other genres of the human, and multiple worlds and ways of being members of collectives come into view here.³⁷ Other ways of thinking about forest work—in contrast to the “Hothouse Earth” scenario—also emerge here. Mapping and monitoring with remote sensing platforms, forest watch toolkits, and sensing technologies are one way to figure modes of engagement with forests. Yet from within this reworking of the planetary and the human, there are still many other pre- or postaccumulative modalities, media, and storylines that might be recognized and created. Becoming planetary is a way to consider how the planetary is not a uniform or fixed set of conditions, but rather signals conditions of difference, as well as collective responsibility and possibility with and through those differences.

- 1 Gayatri Chakravorty Spivak, "Imperatives to Re-Imagine the Planet," in *An Aesthetic Education in the Era of Globalization* (Cambridge, MA: Harvard University Press, 2012), 338.
- 2 Sylvia Wynter in conversation with Katherine McKittrick, "Unparalleled Catastrophe for Our Species? Or, to Give Humanness a Different Future: Conversations," in *Sylvia Wynter: On Being Human as Praxis*, ed. Katherine McKittrick (Durham: Duke University Press, 2015), 23.
- 3 NASA Earth Observatory, "World of Change: Amazon Deforestation," available on the Nasa Earth Observatory website.
- 4 Elizabeth Zubritsky, "New NASA probe will study Earth's forests in 3D," NASA Global Climate Change, September 8, 2014.
- 5 Elizabeth DeLoughrey, "Satellite Planetarity and the Ends of the Earth," *Public Culture* 26, no. 2 (2014): 261.
- 6 Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge: MIT Press, 2010), 25.
- 7 Gayatri Chakravorty Spivak, *Imperatives to Re-Imagine the Planet* (Vienna: Passagen Verlag, 1999).
- 8 Katherine McKittrick, ed., *Sylvia Wynter: On Being Human as Praxis* (Durham, NC: Duke University Press, 2015).
- 9 Harun Farocki, "Phantom Images," *Public* 29 (2004): 12–22.
- 10 Jennifer Gabrys, "Sensing an Experimental Forest: Processing Environments and Distributing Relations," *Computational Culture* 2 (2012).
- 11 Spivak, *Imperatives*, 74
- 12 Gayatri Chakravorty Spivak, "Planetarity" in *Dictionary of Untranslatables: A Philosophical Lexicon*, ed. Barbara Cassin (Princeton: Princeton University Press, 2014).
- 13 For a discussion of the unsettling of these "global-world-spaces" within this collection on Accumulation, see Kathryn Yusoff, "Epochal Aesthetics: Affectual Infrastructures of the Anthropocene," in this volume pages 13–25.
- 14 Gayatri Chakravorty Spivak, "Planetarity," in *Death of a Discipline* (New York: Columbia University Press, 2003), 71–102.
- 15 Spivak develops and reworks the planetary and planetarity in many more texts beyond these.
- 16 Spivak, *Imperatives*, 54.
- 17 Spivak, *Imperatives*, 44.
- 18 On these different renderings of science within Aboriginal land practices, see Helen Verran, "A Postcolonial Moment in Science Studies: Alternative Firing Regimes of Environmental Scientists and Aboriginal Landowners," *Social Studies of Science* 32, no. 5–6 (December 2002): 729–762.
- 19 Spivak, *Imperatives*, 80.
- 20 Spivak, *Imperatives*, 48.
- 21 The concept and phrase—*being planetary as praxis*—that I develop here is an extension on this phrase coined by Wynter, which she further elaborates in conversation with Katherine McKittrick in the stirring collection, *Sylvia Wynter: On Being Human as Praxis*.
- 22 Sylvia Wynter and Katherine McKittrick, "Unparalleled Catastrophe for Our Species?" in McKittrick, ed., *Sylvia Wynter*.
- 23 Wynter and McKittrick, "Unparalleled Catastrophe for Our Species?."
- 24 Wynter is influenced by Marx in her understanding of praxis, but also draws on Judith Butler in her discussion of praxis and gender, which she develops into an original take on storytelling, code, neural science, and being human as praxis.
- 25 Marisol de la Cadena, "Uncommoning Nature," *e-flux journal*, no. 65 (May 2015).
- 26 Sylvia Wynter, "Unsettling the Coloniality of Being/Power/Truth/Freedom: Towards the Human, After Man, Its Overrepresentation--An Argument," *CR: The New Centennial Review* 3, no. 3 (Fall 2003): 257–337.
- 27 Will Steffen, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Ricarda Winkelmann, and Hans Joachim Schellnhuber, "Trajectories of the Earth System in the Anthropocene," *PNAS* 115, no. 33 (August 14, 2018): 8252–8259.
- 28 Steffen et al., "Trajectories," 8254.
- 29 Steffen et al., "Trajectories," 8256.
- 30 Spivak, "Planetarity," in *Death of a Discipline*, 72.
- 31 Climate migration and its consequences for social and environmental justice is a topic addressed through numerous research articles and reports. For example, see Andrew Baldwin, "Racialisation and the Figure of the Climate Change Migrant," *Environment and Planning A* 45, no. 6 (June 2013): 1474–1490. At the same time, this topic is the focus for security and development, as is evident through the report: Kanta Kumari Rigaud, Alex de Sherbinin, Bryan Jones, Jonas Bergmann, Viviane Clement, Kayly Ober, Jacob Schewe, Susana Adamo, Brent McCusker, Silke Heuser, and Amelia Midgley, *Groundswell: Preparing for Internal Climate Migration* (World Bank, Washington, DC, 2018), <https://openknowledge.worldbank.org/handle/10986/29461>.
- 32 Wynter and McKittrick, "Unparalleled Catastrophe," 17. Wynter draws here on Aimé Césaire's "Poetry and Knowledge," in *Refusal of*

- the Shadow: Surrealism and the Caribbean*, ed. Michael Richardson (New York, Verso, [1946] 1996), 134–146.
- 33 Pascal David, “Welt,” in *Dictionary of Untranslatables*, 1217–1224.
- 34 Alfred North Whitehead, *Modes of Thought* (New York: The Free Press, 1966 [1938]). This planetary approach potentially runs up against Wynter’s configuration of the subject within autopoietic systems, where subjects construct environments—unless subjects are extended to multiple other entities. This discussion of auto-poiesis and subject-superjects is a topic for another study.
- 35 , “To the Planetarium,” *One-Way Street, Reflections*, 93.
- 36 I have previously discussed the becoming environmental of computation to consider how sensor technologies configure and distribute environmental experiences. Through this discussion, I suggest this extended encounter with the planetary, the human, and praxis could stir a different constellation of the planetary aspects of media and technology, especially as configured in relation to climate change. See Jennifer Gabrys, *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet* (Minneapolis: University of Minnesota Press, 2016).
- 37 Eduardo Kohn, *How Forests Think: Towards an Anthropology Beyond the Human* (Berkeley: University of California Press, 2013); Eduardo Viveiros de Castro, “The Crystal Forest: Notes on the Ontology of Amazonian Spirits,” *Inner Asia* 9, no. 2 (2007): 153–172.

Particular Sensibilities

Nerea Calvillo



The air is a space, an object, a threat, a myth, a weapon, a commons. While it might have once been forgotten, as feminist philosopher Luce Irigaray claims, the air is a space of great attention today.¹ For scholars in disciplines such as human geography or anthropology, it has become prolific in capturing atmospheric conditions that bring together the meteorological and the affective; a conceptual tool to help “deterrestrialize” anthropological thought; and a thinking method in itself, of being in suspension.² Other scholars have recently explored how the air has become a cultural object through history, the space of war, of governance, and of environmental activism, among others.³

No matter how conceptually useful and seductive the air is, by making a case of its specificity and distance we risk treating the air as something “out there,” thus preventing individual and collective responses. That said, the air just above the ground, the troposphere, the messy space where we breathe and live along with other beings, is not a heroic space to be conquered or a space of great disasters, but one of routines. It is an air that is different in every corner and circulates in unexpected ways, where the differences of environmental injustice are more palpable. We cannot escape this air. It is the air that comes into our body through our lungs. It is the air in which dogs bark, where bees fly and spread pollen. It is the air that is part of our urban ecologies and territories, filling our open, public spaces. It is not just this though. It is also the air of capitalist and neoliberal accumulation, the disposal space of industrial, technological, and farming production systems. It is the air of inequality, injustice, and of slow and invisible violence.⁴ As a space of accumulation itself, it retains heavy metals released by factory chimneys and toxic human-made chemical compounds. It also suffers from an excess of its own components, like carbon dioxide, carbon monoxide, nitrogen dioxide, or formaldehyde, just to name a few, that are released by industry, traffic, and consumption. The polluted air is one that contributes to producing alterlives, chemically altered lives and beings.⁵

This thin section of the atmosphere has materiality, yet one which we cannot normally see with our eyes. To study it, the infrastructures, devices, practices, and bodies that make the air visible become an intrinsic part of it. Science accounts for this accumulation through numbers and concentrations, but this account only provides for one condition of pollution and suggests technoscientific stories as “solutions” concerned with cleaning it through massive geoengineering projects. In a similar manner to climate change, numbers become too abstract and detached from reality for people to engage with them in meaningful ways. As Rob Nixon claims, “the scale of the climate issue can make it feel unmanageably abstract. I believe it’s the role of artists and gifted climate

communicators to help bring home the perturbing changes, to make them visceral, textured, intimate.”⁶ How, then, can we bring home the air’s accumulated excess, make it visible and sensible with alternative monitoring practices, and tell other stories?

Attentive Speculation

Paying attention to existing infrastructures and unpacking their material, social, and political assemblages provides an idea of what they put at stake, how they articulate certain narratives, and ultimately, the effects of their design decisions. However, studying infrastructures poses a methodological challenge, as infrastructures tend to be invisible.⁷ As opposed to studying them when they break, which is when they become visible, we can perform an “infrastructural inversion,” meaning to look at the infrastructures we do not see, and “think with care” or focus on what has been neglected or forgotten, left out through choices, histories, or policies.⁸ Within this context, speculation becomes a strategy to imagine or practice alternative futures, to explore other possibilities, to not take for granted what there is and reject the common assumption that there is nothing to be done to care for the environment.⁹ Thus, “attentive speculation” is a design method to unpack the invisible and the black-boxed that by asking “what if” aims to re-articulate what exists in ways that might suggest other narratives or other futures, or a process that Isabelle Stengers describes as:

In short, histories that bear on thinking together as a work to be done. And we need these histories to affirm their plurality, because it is not a matter of constructing a model but of a practical experiment. Because it is not a matter of converting us but of repopulating the devastated desert of our imaginations.¹⁰

Fussing Aims

Air pollution models and institutional visualizations are developed to predict air quality so that people can adjust their daily activities accordingly. By making us look into the future, these images distract us from looking at the past, at the histories of pollution. What if instead of aligning with positivist understandings of information—where knowledge produces individual behavioral change—we pay attention to the collective effects of pollution? This shifts the aims of the visualization from “solving” individual problems to “fussing” with air pollution, where “the very strength of [making] a fuss is not

to represent the True, [but] rather to be witnesses for the possibility of other ways of doing what would perhaps be better.”¹¹

Attentive speculation is a method of unpacking, speculating, and constructing environmental infrastructures. *Yellow Dust* (YD), an example of this method, is a measuring and visualizing infrastructure which suggests a form of design and inquiry that expands the ways of relating to toxic air.¹² By not trying to solve the problem, but rather fussing with the aims of visualization, YD makes the problem of air pollution visible, present, and uneven. It looks at the history of pollution to recognize places that have always had bad air quality and connects environmental vulnerability with spatial and social factors.

Infrastructuring Location

There is often a disconnect between the place where air is being measured (the sensor) and where that data is seen (a screen). YD not only makes the air whose quality is in question visible in situ, but also registers the very specificity of its site.¹³ YD collects data from its immediate surroundings using two low-cost sensors. This data differs from available data from the Seoul Metropolitan Government, as the closest official monitoring station is still far from the public space in which YD was located.

YD aims to contribute to advocacy not by providing datasets, but by increasing the ways in which a specific location is managed and known. This brings up an ethical concern: aside from generating awareness and potentially leading to direct action, localizing pollution might have adverse effects on the lives of its local community. Crime maps, for instance, have contributed to the stigmatization of neighborhoods, with property prices decreasing and increased isolation, all without the problem of criminality being addressed. We have to think carefully not only about where the air should be made visible, but also about its potential side effects. For while YD measures and makes the air visible in the same place, it is not necessarily a demonstrational device that indicates how to reduce air pollution. It aims to be an instrument that produces connections, generates questions, and produces provocations, one that brings humans and more-than-humans into a cosmopolitical experiment.¹⁴

Airing Pollution

Of all the gases and particles that comprise the air, which ones should be made visible? Those components with the highest concentrations or those that are the most controversial? Local emissions or transboundary ones? Paying attention to what matters

about pollution and thinking which of the particles and gases and their effects are worth making visible is a form of making air pollution a matter of concern, of airing the issue of pollution. This ultimately entails discussing not only its concentrations, but also its politics.

YD shifted the conversation from “how much” to “who is emitting.” Particulate matter concentrations are usually high in Seoul, but the government and the media attribute them to *Hwangsa* (“yellow dust” in Korean): transboundary fine soil particles that are carried by the wind from Mongolia and Northern China mostly during the spring and that bring other types of industrial pollutants with them. Although there are frequently high levels of particles created by local sources, *Hwangsa* creates a sense of matter out of place, of a nonhuman invasion that reinforces the distinction between local and foreign air, and has triggered legal and political international battles.¹⁵

YD aimed to unsettle the idea of the yellow dust as a foreign and unwanted entity. By identifying whether there was local particle pollution in Seoul’s atmosphere in the months when *Hwangsa* was less present, YD helped to locate oneself within conditions that are simultaneously local and planetary. In reference to *Hwangsa*, YD’s mist was colored with yellow light, putting this cultural bias to work. This moves away from the correlation usually established in visualizations between air pollution and the Air Quality Index, a color gradient that correlates particle concentrations with their effect on human health, and where yellow means below the legal limits.¹⁶ The reason for avoiding this relation is to find other modes of attending to the air beyond human health. This is not to say that human health does not matter, but on the contrary: it takes into consideration that every body—human or more than human—reacts to pollution differently. To account for all these diverse sensitivities, YD does not specifically address any specific body, and focuses on what touches the collective; the social effects of pollution.

Dissipating Data

In scientific visualizations, diverse elements are treated in the same way: for example, temperature, precipitation, and air particles are all shared through the same type of graphs or pie charts, with a label as the only differentiator. Their qualities and properties are not taken into consideration, leaving them as abstract entities. To engage with pollution differently, what if we paid attention to the material properties of our objects of research and play them out? What if their visualizations perform as the objects they re-present? In his series *Green River* (1998), Olafur Eliasson dyed rivers with uranine, a nontoxic, water-soluble dye used to test ocean currents,

to make passersby aware of their surroundings. In a similar vein, HeHe's (Helen Evans & Heiko Hansen) *Nuage Vert* (2008) projected a massive green laser onto the smoke coming out of a factory's chimney to make citizens aware of pollution. Following this tradition, YD does not make data or emissions visible, but rather creates a visualization that dissipates into the environment, the air itself.

If we take the air's material conditions seriously, due to its fluidity and constant transformation, it is not possible to display data with resolution. Perhaps the air is an opportunity to move away from the endless thirst for resolution (both in sensing and visualizations) and find alternative forms of dealing with toxicity. Instead of decodifying information, by dissipating data, YD suggests forms of attuning to toxicity, of recognizing or detecting it.

Embracing Matter

Materiality poses resistance to ideas. When designing an early YD prototype in 2008, I visited an atmospheric scientist. When I asked her how to "taint" the air, she responded furiously, saying that I had no idea what I was talking about, that it was not only absurd and difficult, but also illegal to release gases or particles into the air (despite the fact that factories do so on a daily basis). Being unable to contribute to pollution brought other material properties and representational capacities of air to the fore, such as water, which brought new experiential and spatial opportunities.

Mist is visual but it can also be felt by other senses. It also alters the environmental conditions of a space. Mist blurred the edges of Fujiko Nakaya's *Pepsi Pavilion* at Expo '70 in Osaka. Mist was meant to serve as a display for art and information projections in Diller + Scofidio's *Blur Building* for Swiss Expo 2002. In YD, mist revealed the constitution of the air that composed it and contributed to expanding embodied encounters with data and the climatic effects of infrastructures.

Permeating Experience

Studies on the impact of air pollution data in citizens have demonstrated that information does not necessarily produce behavioral change. In fact, quite often, it leads to indifference and even fear.¹⁷ Data requires interpretation, and scientific visualization formats require a certain visual literacy. Artistic or architecture projects like Andrea Polli's *Particle Falls* (San José, 2010) or The Living's *Living Light* (Seoul, 2009) have worked to create more visually appealing and seductive encounters with data. Yet all these cases reinforce

vision as the only way of knowing, relegating other senses to the realm of feeling. What if instead of making data visible, we make it sensible?

Water vapor creates a soft mist of humidity that can be experienced through breath and skin contact. It makes data permeable, democratizing the perception of air pollution and highlighting the unevenness of its effects. Only sensitive bodies sense pollution, but it is likely that more bodies sense humidity. With YD, on days of high particle concentrations (Hwangsa-related or not), several modes of sensing overlap: visual through the color of pollution and of the mist; skin-based via the humidity and the temperature of the mist; and the nose, eyes, or lungs for particle-sensitive bodies. Water vapor can also alleviate the symptoms of asthma, so YD may also serve as a relief for some. Overall, it produces an overlapped—even excessive—sensorial experience. Thus, the decoding of air pollution is not immediate, and it may take time for passersby to be able to compare particle concentrations with earlier hours or previous days. It is an infrastructure that moves away from speed-of-information tropes, requiring time getting to know it and for bodies to become trained to sense different intensities.

Wetting Urban Space

Mist not only expands modes of sensing data, but also demands we pay attention to the conditions of the urban space. Wetting the data transforms the air's temperature and humidity, which can be useful during autumn and spring, the dry season—during the wet season there is normally no air pollution so there would be no water vapor). The mist also “infrastructures” the urban space.¹⁸ What if an infrastructure monitors, makes visible, and remediates at the same time? By wetting the data, YD also wets the urban space, helping remediate particulate matter concentrations. As water deposits particles, the mist might reduce their concentrations in that specific location.

By wetting the data, it also becomes distributed across space and time in an untraceable way, creating a sort of atmospheric media that brings together technologies and urban conditions below the threshold of sensing.¹⁹ Media and the air become the same thing, elemental conditions that act like a chemical interaction, a milieu, and an environment.²⁰ It is not possible to distinguish between the technology and the matter upon which it acts, as the infrastructure and what is sensed cannot be disentangled, nor even distinguished. The water vapor dissolves into the air, becoming one. Not only does the infrastructure become atmospheric, but it makes the air infrastructural by being the support of its own data, making itself visible.

Commoning Infrastructures

Scientific and policy making air monitoring devices tend to be invisibilized and black-boxed, focused exclusively on gathering the most accurate and stable data. Yet their invisibility is a problem, in that it reduces the possibilities for people to understand their performance, and the potential to intervene.²¹ What if we make not only the air visible, but also the infrastructure itself? What are the limits of visibilizing an infrastructure?

YD revealed its own infrastructure—the steel cable supporting the water vaporizers, the sensors, the cables that channel the water, the LED lights, etc.—as well as all the devices required for it to function: the water pump, the micro controllers, the Arduino, and so on. From an ecosystemic perspective, it also made visible what it takes to monitor and display air pollution information, through small water and energy meters that display its own consumption. YD politicizing its engagement with the toxicity of the city by opening up its monitoring process and making its performance visible.²² Diagrams for its replicability were made available to make the project not only an infrastructure of the common air, but also an infrastructure for an expanded idea of the commons, one that addresses alternative ways of being together.

YD and similar projects will not “solve the problem” of air pollution. To solve the problem of air pollution we need to stop economic growth, radically change the ways we use and produce energy, food, and manufactured products—just to begin with. YD also does not create a parliament where humans and more-than-humans come together. YD is an experiment to test if it can be an infrastructure for the transition.²³ It is a blurry, intimate space of cohabitation where we can imagine other relations with our urban ecologies and contribute to repopulating the devastated desert of our environmental imaginations.

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- 2 Derek P. McCormack, “Elemental Infrastructures for Atmospheric Media: On Stratospheric Variations, Value and the Commons,” *Environment and Planning D: Society and Space* 35, no. 3 (November 2016): 1–20; Cymene Howe, “Life Above Earth: An Introduction,” *Cultural Anthropology* 30, no. 2 (2015): 207; Timothy K Choy and Jerry Zee, “Condition-Suspension,” *Cultural Anthropology* 30, no. 2 (2015): 210–23.
- 3 Peter Adey, *Air: Nature and Culture* (London: Reaktion Books, 2014); Peter Sloterdijk, *Terror from the Air* (Los Angeles: Semiotext(e), 2009); Mark Whitehead, *State, Science and the Skies: Governmentalities of the British Atmosphere* (Hoboken, NJ: Wiley-Blackwell, 2009); Timothy Choy, “Air’s Substantiations,” in *Lively Capital: Biotechnologies, Ethics, and Governance in Global Markets* (Durham: Duke University Press, 2010).
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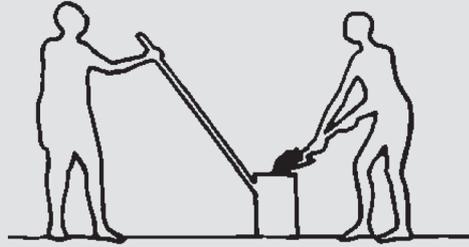
- 5 Michelle Murphy, "Alterlife and Decolonial Cematic Relations," *Cultural Anthropology* 32, no. 4 (2017): 494–503.
- 6 Rob Nixon, "Dead Metaphors, Dying Symbols and the Linguistic Tipping Point," *The Climate Change Project*, blog, September 5, 2018.
- 7 The networks of sensors, information panels, and apps that measure and attempt to make the air visible tend to be ubiquitous yet small, and often made invisible for political reasons. Nerea Calvillo, "Political Airs: From Monitoring to Attuned Sensing Air Pollution," *Social Studies of Science* 48, no. 3 (July 2018): 372–388.
- 8 Susan Leigh Star, "The Ethnography of Infrastructure," *American Behavioral Scientist* 43, no. 3 (November 1, 1999): 377–91; Geoffrey C. Bowker, *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920–1940* (Cambridge, MA: The MIT Press, 1994); Maria Puig de la Bellacasa, *Matters of Care: Speculative Ethics in More Than Human Worlds* (Minneapolis: University of Minnesota Press, 2017).
- 9 See de la Bellacasa; Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham: Duke University Press, 2016); and many others. Speculation furthermore assumes a lack of closure and an uncertainty about the outcomes that also requires other forms of evaluation; see Michael Guggenheim, Bernd Kräftner, and Judith Kröll, "Creating Idiomatic Speculators: Disaster Cosmopolitics in the Sandbox," in *Speculative Research: The Lure of Possible Futures*, ed. Marsha Rosengarten, Martin Savransky, and Alex Wilkie (London: Routledge, 2017), 145–62.
- 10 Isabelle Stengers, *In Catastrophic Times: Resisting the Coming Barbarism*, trans. Andrew Goffey (London: Open Humanities Press, 2015), 132.
- 11 Vinciane Despret cited in Haraway, *Staying with the Trouble*, 130–131.
- 12 *Yellow Dust* was designed by C+arquitectos/ In the Air (Nerea Calvillo with Raul Nieves, Pep Tornabell, Yee Thong Chai, Emma Garnett, Marina Fernandez). The project was commissioned and produced by the Seoul Biennale of Architecture and Urbanism 2017 with the support of Acción Cultural Española and an impact ESRC IAA grant from University of Warwick and the Economic and Social Research Council (ESRC).
- 13 Precise measurement is essential for advocacy and environmental justice projects. Nicholas Shapiro, Nasser Zakariya, and Jody Roberts, "A Wary Alliance: From Enumerating the Environment to Inviting Apprehension," *Engaging Science, Technology, and Society* 3 (September 28, 2017): 575–602.
- 14 Steve Hinchliffe, Monica Degan, Matt Kearnes, and Sarah Whatmore, "Urban Wild Things: A Cosmopolitical Experiment," *Environment and Urban Planning D: Society and Space* 23 (2005): 643–58.
- 15 Mary Douglas, *Purity and Danger: An Analysis of Concepts of Pollution and Taboo* (London: Routledge, 1966).
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- 18 Anders Blok, Moe Nakazora, and Brit Ross Winthereik, "Infrastructuring Environments," *Science as Culture* 25, no. 1 (2016): 1–22.
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Bad Earth

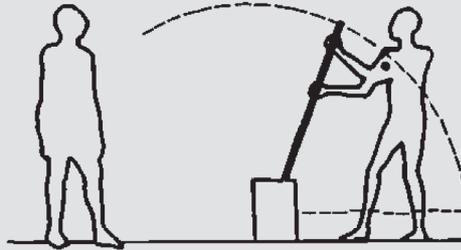
Hannah le Roux
and Gabrielle Hecht

There are three basic steps in the operation of most hand presses:

- loading the mold box;

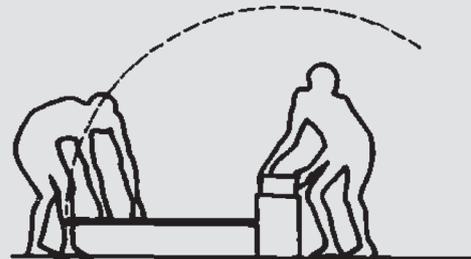


- compressing the mix;



- ejecting the block.

With any hand press, it is a good idea to make a few test blocks before starting production in order to determine the correct amount of mix needed to make a strong block.



Every year, humans move more earth, and more rock. More than rivers carry with them as they rush to oceans and lakes. More than erosion occasioned by wind, or rain, or seasonal frictions. More than the lava hurled out by volcanoes. More, in fact, than all planetary forces combined. And faster, too; a few decades of human activity have displaced more materials than the planet could over millennia. This is what it means to say that humans have become a geological force, that the earth has entered the era of the Anthropocene.

“Humans,” of course, is far too broad a descriptor to capture the causes, mechanisms, and effects of all this earthly displacement. The generic category of “human” as an agent of change only makes sense if you’re a planet. We all know that some humans—bolstered by the political systems in which they live and the institutions for which they work—are far more powerful than others.¹ The quantity of rock moved by an Anglo-American during the more than a century of metal mining completely overwhelms that displaced by a migrant scraping the walls of abandoned mine shafts. But the differences are not just a matter of magnitude. More fundamentally, they are about the inequities that enabled and conditioned this massive scalar difference, and that continue to be amplified by it. The apparent incommensurability of these scales must not blind us to their deep interdependence. This is especially evident in the use of mine waste as building material, which involves a triple extraction: of minerals, of waste, and of human health.

The increasing precarity of life on our planet may dispose us to see this use of discarded matter as an unalloyed good. Surely it’s better than removing yet more of the planet’s matter? Billions of people lack adequate shelter, after all. The need for large-scale, low-cost housing constantly outpaces its construction, as well as the availability of land to build on. The vast growth of mineral extraction since the 1940s has been accompanied by a proliferation of experiments in the remining of their waste products. These approaches, in turn, have relied upon—and also generated—a patchwork of modular building materials, framed by modernity’s perpetual penchant for scalability, while simultaneously containing its dark consequences. The promises of postcolonial modernity—housing, health, prosperity—tacitly assumed that these materials would be clean, abundant, and neutral: the unremarked and unremarkable means to a greater end, not sources of trouble in and of themselves. Put differently, the assumption was that the materials of postcolonial modernity were “raw”: in a state of nature, there for the taking, ready to be molded, unsullied and unaffected by previous use.

Yet many of the materials of modernity were not, in fact, inherently neutral. This was not—is not—merely a political statement. It also reflects material reality: runoff from abandoned mines, produced by the chemical reaction of exposed pyrites with oxygen,

acidifies soil and water. As the ruins of mining and other industrial activity continue to spread, unchecked acid mine drainage renders ever-larger plots of land unfarmable, and ultimately unlivable. Bauxite, gold, uranium, asbestos, iron, copper, and especially coal all generate gigantic footprints and piles of waste. No surprise then that these materials seduced builders, engineers, and architects. Using mine waste as a construction resource appears to address two problems at once: what to do with the waste material and land, and how to build low-cost shelter for the many thousands of workers required to run extractive processes.

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Archaeologists have found evidence that Spanish settlers in seventeenth- and eighteenth-century Mexico used tailings from silver mines in building the adobe haciendas that constituted the loci of their colonial power.² These buildings bear traces of the mercury used in silver amalgamation, suggesting that their erosion may have released toxins to their inhabitants. Even earlier antecedents surely exist. The reuse of mine waste is nothing new.

What *has* changed, however, is the scale and shape of such reuse, along with the intensity, spread, and characteristics of contamination it can generate. By 1968, when the US Bureau of Mines began sponsoring national symposia on the use of mine waste in construction, researchers and industrialists were exploring the use of waste from iron, copper, and phosphate mining, as well as fly ash (from coal), ferrous and non-ferrous scrap, and more.³ As one meeting chairman explained, the symposia were built on the premise that pollution and waste offered “opportunities,” whose technical and economic feasibility could be explored: “Incentives, rather than hysteria, offer a sound path toward eliminating the pollution problems of air, water, and land.”⁴ Turning waste into resource certainly seemed like the perfect industry response to the burgeoning environmental movement. Indeed, with this effort originating two years before the creation of the US Environmental Protection Agency, the mining sector appeared positively proactive.

By 1979, RILEM (now the International Union of Laboratories and Experts in Construction Materials, Systems, and Structures) reported on some twenty countries where mineral waste supplied the formal construction industry. The largest proportion of these materials consisted of metallurgical slags and fly ash. But mine and quarry waste also contributed significantly to road construction, fill, concrete aggregates, and—in a few instances—the manufacture of bricks and plaster. The US dominated RILEM’s list, though as symposium reporters noted, this could simply be the result of more information; “in most other countries... [mine] wastes are often

produced in remote areas where little attention is paid to them.”⁵ The authors noted, in passing, that “some of the mine tailings, e.g. those containing heavy metals, uranium, or asbestos may present problems of toxicity and their disposal will accordingly need to be carefully controlled.”⁶ Nevertheless, in 1979 the authors estimated that the annual production of waste rock from uranium extraction produced some 155 million tons of waste rock in the US, where some of it fed bituminous concrete aggregate. “There have been problems of radioactivity,” the authors remarked, in bloodless prose. Overall, however, they concluded that raw mine waste saw less uptake than other mineral discards, primarily because in most countries, mines “tend to occur away from populated areas and the cost of transport makes them uneconomic in comparison with competing materials.”⁷

Construction projects located near mines and their waste, however, don’t face the problem of transportation costs. In such instances, the economy of waste reuse could seem attractive—particularly in postcolonial states seeking a fast track to modernity. Undoubtedly, this influenced decisions about building materials for the mining town of Mounana, Gabon shortly after its erection in the 1970s. Each house, complete with electricity and running water, sheltered a mineworker and his family according to European nuclear family norms (no polygamists, no extended kin) and lifestyles (no chickens, no goats). In the center of town, residents could shop at the marketplace. Women delivered their babies at the maternity clinic. Children attended school. In the late 1970s, Mounana represented Gabonese “expectations of modernity” via national and corporate projects. In what appeared as a model of efficiency, waste rock from the nearby mines served as the basis for the gravel, cement, and concrete in these structures and in the paved roads that connected it with the town.⁸

This rock, however, was not inactive. It came from the uranium shafts that powered economic activity in postcolonial eastern Gabon. The uranium content in the discarded rock was too low to extract profitably. But it was still there, and it did what uranium always does: it decayed, releasing radioactivity along the way, gradually turning into radon gas. Three decades later, and years after the mine had shut down, local activists and French NGOs found radon levels in these structures well in excess of internationally recommended limits. In the end, the mining town—which continued to lodge people after the company’s departure—had found a sure-fire way to make families nuclear.⁹ The materials of modernity had become instruments of slow violence.

This outcome shouldn’t have surprised the French-owned *Compagnie minière d’uranium de Franceville* (COMUF). In 1971, revelations broke that one-third of the houses in Grand Junction,

Colorado were bursting with radon because they'd been built with tailings from the uranium mills that powered that town's growth. Ninety miles further south, some homes in Uruvaco had radon levels over 700 times regulatory limits; subsequently abandoned, the town became a Superfund site. In 1975, a survey demanded by the Navajo Tribal Council found radioactive buildings strung out from Shiprock to Tuba City. Many of these sites in the Navajo Nation remain unremediated, potent reminders of the everyday violence of the white settler state.

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During the nineteenth century, permanent buildings—what French colonial officials called “construction *en dur*”—rather than those built from perishable materials, constituted a key element of the “civilizing mission.” In the colonial imagination, modernity required stone, or at least stone-based materials such as concrete or fired clay bricks. Buildings that needed seasonal maintenance to maintain their structure were coded as *indigène*, inferior. Europeans built solid homes in the tropics, and they assumed that their colonial subjects held the same aspirations. Throughout the mid-twentieth century—including during the times of imperial decline, independence, and postcolonial possibility—the trope of the “solid house” remained a symbol of concrete modernity for many postcolonial societies seeking to build new nations.

Yet the material and economic conditions of postcolonial state-building undermined these ambitions. The ingredients of modern building were themselves exported or taken up in the infrastructure needed for resource extraction. To make concrete, grand projects extracted selected grades of sand and aggregate, quarrying them from the total amount of earthly resources. The remnants—typically degraded soils—served as both sites and building materials for housing the global poor.

In response, new taxonomies of earthly materials and building elements emerged. Political and chemical forces concretized these taxonomies by bringing them into relation. Wartime scarcities of the 1940s coincided with experiments in sand, earth, or mud blocks, all stabilized by the addition of cement, with hybrid names such as sandcrete, landcrete, and swishcrete. Some technologies emerged from trials in American agricultural research centers, including the Tuskegee Institute, and were tested in Africa at research stations.¹⁰ Cement additives circumvented the need for skilled local builders and their ability to create durable structures by combining earths and organic render mixes with materials such as cow blood, urine, dung, chicken feathers, and plant fibers.¹¹

In the flush of early independences, the biggest challenges seemed to revolve around cost and scale: how to build large numbers of solid houses in which the newly enfranchised poor—particularly in the tropics—could live, and perhaps even thrive. The need for new houses that met acceptable standards, in the UN's 1952 account, was staggering: twenty-five million homes in Latin America, homes for one hundred to one hundred and fifty million families in Asia, and enough for “just about” all the people in Africa.¹² Rejecting requests for more money from the Global South—or anything that might resemble a Marshall Plan for decolonizing territories—UN experts, many of whom had previously worked for colonial governments, instead emphasized the importance of low-cost techniques and individual self-financing.¹³ Cement-stabilized earth blocks fell neatly into this austere approach: since as much as ninety-five percent of the block volume consisted of nominally free, local, earthly material, capital reserves could be channeled to infrastructural elements such as sanitation, sheet roofing, and cement.

But there's no such thing as a free block, and development aid always comes at a price. Consider the Landcrete press, designed in the early 1940s in South Africa by Landsborough Findlay, a company specializing in earth-moving equipment for mines and farm land. The company's international marketing efforts succeeded: in 1953, the United Nations Korean Reconstruction Agency bought one hundred presses to help build a million homes for war refugees.¹⁴ As modular elements, landcrete blocks could be traded ubiquitously, from very basic production yards to housing sites. UN sponsorship of block making machines did much to displace indigenous earth building with a fragmented and interchangeable vision of building, couched in the idea of “self-help” in international “development.”¹⁵ And as M. Ijlal Muzaffar documents, the “participating native” was a central figure in this discourse, which unabashedly celebrated “traditional” building techniques and indigenous “ingenuity”—even as it worked to supersede local expertise—while claiming to represent “the demands and desires of populations already in transition to modernity.”¹⁶ As presses such as the Landcrete (which had many successors and spin-offs) gained traction in international development circles, blocks replaced solid earth in the building envelope.¹⁷ In the same years that Western photographers began training their cameras on the marvels of indigenous earth architectures, “development” agencies and technical experts worked to fracture their integrity.¹⁸

Cheap blocks complemented the “roof loan” approach, conceived by UN technical advisors on housing. Working in the Gold Coast (Ghana), the American housing advocate Charles Abrams, along with Vladimir Bodiensky and Otto Koenigsberger imagined

that community savings groups would share loans to buy industrially produced materials to roof the houses with already completed walls that had been built with cheap or personal labor from locally made earth blocks. Rather than evolving together, then, roofs and blocks were recombined in the “self-help” house as elements with diverse procurement paths. Block fabrication could now take place before or beyond the oversight of technical experts, while the roof materials were locked in place through debt.

In this plan, good roofs allowed for bad walls. Protected by the overhang of a relatively durable roof, supported by a sanitary core and pillars, stabilized earth blocks did not have to meet any standards of longevity, size, material, or even delivery timelines. By the 1960s, the roof loan scheme—originally designed to conclude the self-housing process—became its starting point. This inversion allowed experts to abandon recipients, leaving them to finish their homes entirely by themselves, while repaying the roof loan to their community savings group.¹⁹

Roof loans also opened the market for asbestos cement and corrugated aluminum roofs, along with corrugated iron.²⁰ These sheetings performed similarly in the warm, humid tropics.²¹ Their specification related to the availability of raw materials, all of which generated potentially toxic residues and landscapes. In Ghana, for instance, the Volta Aluminium Company began construction on an aluminum smelter in 1964, with the view to make construction products from its bauxite ore mines.²² In South Africa—with its rich reserves of asbestos, iron ore, and strip-mined coal—asbestos-cement roofs and corrugated iron split the market. In both countries, such beneficiation of raw materials made some economic sense. But for countries without minerals, importing any of these materials represented a burden.

In this assemblage of debt, roofs, and unfinished walls, waste served as a basic material for cheap, locally made blocks. Discarded material could substitute for good earth, ideally leaving it as soil for farming. Co-locating housing with borrow pits and other “drosscapes” made discards readily available as construction material.²³ In countries with mineral resources, low cost housing near mines and mills would use materials created as byproducts in industrial processes, including red mud from bauxite tailings from alumina extraction, as well as tailings from zinc, copper, gold, asbestos, uranium, and iron mines.²⁴ Portland cement, the ubiquitous stabilizing material, was mixed with waste, including lime sludge, slags, and fly ash.

The consequences of this regulatory arbitrage around mining waste in building materials are rarely documented. One exceptional study, however, assessed the risk of exposure to dangerous fibers around former asbestos mining sites in South Africa, and

then trained villagers to collect samples from houses and schools built from local blocks. Their focus was on those structures that might contain materials gleaned from nearby tailings in the blocks, floors, and plaster.²⁵ Of thirty-one sites surveyed in the village of Sedibeng, near the mining center of Kuruman, eighty-eight percent of blocks, ninety-four percent of houses, and the only school had asbestos containing building materials (ACBM), some in friable blocks that could release fibers into their surroundings.²⁶ In impoverished communities where many elders had contracted fatal mesotheliomas working in now abandoned mines and closed mills, this risk lingers for another generation.²⁷ Another brick in the crumbling wall of wasted modernity.

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In 2019, we travelled the length of the Main Reef Road, which stretches both eastwards and westwards from Johannesburg. Built to serve the industrial gold mines that spawned the city, the road spans much of South Africa's Witwatersrand plateau, known by the same moniker as its currency: the Rand. We wanted to sample the range of blocks—along with their constituent materials—that people can buy to build or expand their homes. How, we wondered, do current residents of the Rand create homes in toxic wastelands, especially in the absence of adequate state housing and land remediation programs?

Launched in 1886, the Rand's mines rapidly became the deepest in the world. Removing "overburden" to reach gold seams, miners extracted billions of tons of rock, formed into gigantic tailing piles and vast slime dams that comprehensively transformed the region's topography in just a few decades.²⁸ By 1911, fifty-two mines formed a nearly 100-kilometer band from Randfontein to Nigel. As their tailings dumps continued to grow, they also became more dangerous. The cyanide leaching of ore to recover gold required milling the ore more finely, which produced smaller dust particles that were even more mobile and inhalable.²⁹ The leaching itself produced vast quantities of sludge that was dumped into the seasonal water pans of the lowest-lying areas, where it leaked into streams and groundwater.

Today, some 1.6 million people live on or very near toxic mine dumps, mostly in former black townships and informal settlements, often in precarious conditions.³⁰ Heavy metals—in no short supply thanks to the dumps and their dust—dissolve readily in the highly acidic water that decants from mine shafts, transporting toxicants such as mercury, arsenic, and lead into groundwater, streams, and farmland. Uranium-laced dust whips into homes and settles on the vegetable patches that residents rely on for sustenance.³¹ Over the

course of recent decades, mining companies (ever-morphing into new ownership structures) have moved this patchwork of tailings, reprocessing them for gold or uranium (or both) before reassembling remaining waste into three superdumps. Water and surface damage form the residual footprints of removed dumps.

Urban planners, municipalities, and provincial authorities continue to imagine this toxified landscape as a vacant space to meet South Africa's perpetual "housing problem."³² In the 1940s, Landcrete—which pressed out solutions to surplus mine sand, abandoned land, and the cost of building materials in a single mechanism, powered by cheap labor—came out of this very landscape. Buildings on the Witwatersrand still amalgamate these elements, albeit at a far greater scale.

Right now, five thousand "affordable" housing units are being built as a flagship project on land cleared by the removal of a dump at Fleurhof, just north of Soweto. But faced with long waiting lists, unhoused residents—no longer willing to accept cramped back-room housing or makeshift informal settlements—have taken construction into their own hands. Inevitably, given both the urgency of housing penury and the lack of state capacity, such building happens without regulatory oversight.³³ In altering existing houses, residents often remove their asbestos-cement roofs, either reusing whole sheets or dumping broken ones in nearby parks and open dumpsites, where they continue to fragment and crumble into deadly fibers. Builders use blocks from nearby roadside brick makers, who in turn collect sand and additional materials from mine residues and other sources of solid waste.

Near KwaThema, a woman sold us some crumbling, pinkish blocks that contained sand gathered from the low-lying residues of dumps that had been removed for industrial-scale reprocessing. Further out on the Main Reef Road, we found an enterprising man making blocks from a dark, sticky gravel that looked like incinerator waste. Operations like his abounded.

Closer to Johannesburg, over the Main Reef Road from Fleurhof, we located a small blockmaking business run by an elderly, weather-worn Afrikaner with a half-dozen employees. Just a few hundred meters downhill from this operation, on the lip of a large abandoned mine cavity, young artisanal "Zama Zama" miners from Zimbabwe and Lesotho had established a basecamp, where they dug around and into the abandoned pits, scavenging rock with potential gold content.³⁴ Block and mining businesses share a crusher belt—and, apparently, the occasional *braai*. The Afrikaner and his staff fashion their ground rock into blocks, which they mainly sell to clients from Soweto. The Zama Zamas put their ground rock through an artisanal treatment process, most likely using mercury to suspend any gold. Three or four times a week, the

police swing by to collect their cut, which explained stern injunctions from both groups to refrain from taking pictures.

Each batch of blocks differs in its exact composition, but all include the toxic remainders of mining. Sold in small loads to backyard builders, they redistribute these residues into residences. Following the precise paths of these many relocations would be nearly impossible. Regulation, in such situations, isn't even the subject of reverie. Utterly unremarked, this new configuration of "self-help" compresses toxic landscapes into the framework of the home. Extraction removes the good earth. The poor inherit the bad earth. They live on it, and in it, and with it. To be sure, there is some bad earth in all of us. But bad earth does its worst in the bodies and homes of those who struggle most for daily survival.

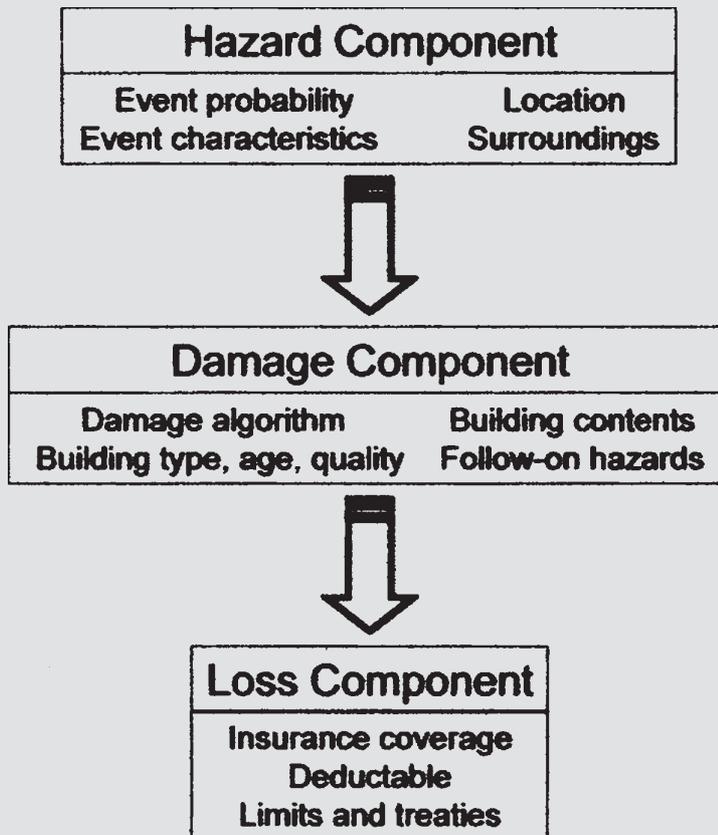
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Damage Functions

Ian Gray



The insurance industry is an influential consolidator of knowledge about risk. Illness after illness, accident upon accident, plague following plague, insurers earn their keep by amassing data about bad things happen to people and the things they own. While insurers do not know what will happen to a specific individual, data of past losses allows them to determine the probability that a calamity will befall a random individual pulled from the population at large. This actuarial knowledge has immense consequence for many sectors of economic and social life. In the realm of natural disasters, for instance, the ways insurers assess risk to property influences both the constructability and design of the built environment.¹ Insurers know which buildings suffer more damage under different disaster scenarios, and adjust their underwriting accordingly. But as climate change renders past data less predictive of future disasters, insurers, and the auxiliary risk analytics firms who serve them, are under pressure to develop new strategies for managing property exposure in climatically vulnerable territories.

Extreme weather has long posed a challenge to traditional modes of risk assessment. Because of their infrequency, catastrophes do not accommodate the kind of actuarial statistics that define most other insurable losses (such as auto accidents, home burglaries, or incidences of cancer). This changed in the 1980s, when a group of third-party companies called catastrophe, or “cat” modelers developed a way of estimating the occurrence of natural disasters using computer simulations. These companies emerged explicitly to serve insurers who, until then, had relied on often informal and imprecise techniques for assessing their exposure to catastrophes. The models combine multiple components. The “hazard module,” for instance, uses stochastic methods to generate thousands of modeled catastrophes based on information about parameters of past disasters. Simultaneously the “vulnerability module” encodes information about the built environment, pulling from databases containing details about all the fixed assets in an insurer’s portfolio (i.e. types of buildings, the materiality of these structures, and their construction dates).

Taking the case of North Atlantic hurricane peril, modelers leverage the small record of landfalling hurricanes managed by the US National Oceanic and Atmospheric Administration (NOAA) to produce plausible “synthetic” storms in the hazard module.² Much like in real life, these synthetic storms unfold in a simulated version of the North Atlantic basin. Many of the storms, similar to reality, spin out to sea, threatening only fishing boats and birds, but some of them turn toward the model’s virtual coast and hit something of value. This encounter between the destructive winds of a synthetic hurricane and the beachfront of a virtual Miami, for instance, occurs over and over again in the model until a statistical distribution is

reached that represents the spread of storms that can be expected in a given territory. This distribution is what produces actuarial-ready damage estimates.

Initially, the simulation of hazards solved the pervasive underestimation of risk that plagued insurers' earlier assessment techniques. But climate change raises new questions about loss estimates based on catastrophe models. This is particularly true as natural disasters appear to be becoming more destructive, eroding the usefulness of historical baseline data provided by institutions like NOAA.³

One response of cat modelers to these changes in extreme weather has been to try and combine data from projective climate models with their simulation techniques. But so far, it has been an uncomfortable fit. Climate models are based on thermodynamic equations of atmospheric behavior, and the computational demands of dynamically (rather than stochastically) estimating phenomena like hurricane activity remains an expensive and commercially untested approach to property-level disaster estimation. This has pushed cat modelers to take scientific shortcuts that have produced questionable loss estimates, which in turn have compelled US insurance regulators to exclude new models from being used to set rates for homeowner insurance.⁴

Due in part to these setbacks, cat modelers are now working to create more legitimacy in their troubled hazard simulations by expanding their knowledge about the built environment. The more information modelers have about the buildings in their databases, the better they can forecast how a building will react under different stresses. This tightens the accuracy of the loss estimates they sell to insurers, regardless of what the weather is doing. Modeling firms are therefore in a race to accumulate "comprehensive" data about existing structures in the US.

Some of the cheapest ways to do this are through spatial imagery captured by drones and planes, or by scraping the web for existing photos of buildings. While partly intended to stabilize confidence in insurers' tools of catastrophic risk assessment, these data practices also partake in broader economic trends of harnessing consumer data, often unbeknownst to the consumer, in order to build more predictive knowledge about individual behavior and needs to the advantage of those who gather the data.⁵ By subjecting the private spaces of our homes to new forms of corporate observation, insurers' moves toward "comprehensiveness" also resemble what the scholar Shoshana Zuboff calls "surveillance capitalism."⁶ The unpredictability of extreme weather is, in a way, a justification for a strategic direction targeting potential future revenue streams that are simply too lucrative for these companies to turn down.

Cataloguing Risk

The built environment is always changing. Therefore, collecting data on vulnerability is a never-ending task. New construction blends with old as building materials and designs evolve in response to changing architectural tastes and urban concerns of the day. Underwriters have an interest in knowing both the value and the characteristics of the structures they insure. As a result, insurers, and the cat modeling firms that support them,⁷ gather rudimentary information on what an early theorizer of cat models called “elements-at-risk”: a catalog of all the buildings contained in an underwriter’s portfolio of insurance policies.⁸ This information is also called “exposure data,” or more colloquially, an insurer’s “book of business.”

From the modeler’s perspective, the most important data is the property’s location, occupancy, height, construction type, and the year that it was built. These are considered the “primary characteristics” of a building and the principal ingredients that a cat modeler uses to assess the building’s vulnerability. For instance, a building’s occupancy depends on its function: is it a residential, industrial, or commercial building? If residential, is it a single-family or multi-family home? An apartment building or a condominium? Construction type captures core materials used in a building’s structure: is the building made from wood or masonry? Is the masonry reinforced or unreinforced? If reinforced, is it by steel or by concrete? Height, meanwhile, matters for perils such as wind, fires, and earthquakes, as these events interact differently with tall structures compared to smaller ones. And the date of construction serves as a proxy for information about the quality and design of a building, captured by changes over the years to local building codes.

This data is stored by modelers in attribution tables that serve to construct mathematical relations between different classes of buildings and their potential for loss under different disaster scenarios. For many buildings, this data is incomplete and modelers have to enter dummy variables into their tables, reducing the accuracy of their forecasts.⁹ Some property owners—particularly of high-value commercial structures—have sought ways to improve how modelers measure their vulnerability in order to reduce their premiums. The owners do this by paying inspectors to collect data on what are called “secondary characteristics.” For commercial and office buildings, these characteristics include finer grained categories of structural design, such as whether parking garages are part of the structure or not. If so, are they below ground or above ground? Is the HVAC system on the roof, or internally housed? Are objects that are inside the building water vulnerable, or water resistant? Are the windows tempered glass or impact-resistant (i.e. coated

with polyvinyl butral or ethylene-vinyl acetate)? Each characteristic implies a different relationship to vulnerability.

To keep track of the information on elements-at-risk, modelers assign codes to each characteristic of a building. These coding schemes, with names such as the Universal Cession Electronic Data Exchange (UNICEDE) and Exposure Data Model (EDM), provide a “data dictionary” of the built environment. Each coded category tethers information about structures in the real world to a standardized taxonomy that is used to catalog and populate a virtual version of insured property within a catastrophe model. The meaningful information for insurers, however, is to understand the potential losses that a disaster, such as a Category 5 hurricane, could cause if it encounters the buildings in their portfolio.

Predicting Loss

The damage caused by a hurricane can be defined mathematically as the effects of a force, such as wind velocity, on the material integrity of a structure in a hurricane’s path. As velocity increases (101 mph, 102 mph, 155 mph, and so on.), structural integrity decreases, until at some point a building is completely compromised (one hundred percent damage). Don Friedman, a pioneer of catastrophe modeling, conceptualized this as the “vulnerability relationships of ‘elements-at-risk.’”¹⁰ In current versions of cat models, this notion of a vulnerability has been further formalized into a family of algorithms called “damage functions.” These mathematical equations predict the behavior of the primary and secondary characteristics of a building to different perils and subperils (fire, flood, and wind, as well as direct wind, wind-borne debris, and wind-driven rain), and allow insurers to estimate the replacement cost value for a structure. For each structural characteristic of a building identified in the catastrophe model coding scheme, there exists a damage function.

New building characteristics typically enter vulnerability catalogues only after a major disaster causes the performance of entire populations of buildings to become visible to modelers. On the ground, damage survey teams gather observations postdisaster that can lead to major changes in how cat modelers craft their predictive equations. Following the 2004 and 2005 hurricane seasons, for instance, two new categories of commercial “occupancy” were added to the models: riverboat casinos and gas stations. Both structures suffered an inordinate amount of damage that the models had grossly underestimated, leading to higher than expected losses for insurers. New damage functions were written to capture the specific vulnerabilities of both occupancy types. Higher vulnerability

frequently translates into higher premiums, and depending on the geography, increases can be significant. In the case of territories facing high hurricane risk in the US, up to forty percent of insurance premiums can go toward covering catastrophic risk and reinsurance costs.¹¹

While “ground-truthing” by modeling teams provide an important feedback loop between the virtual and the material, perhaps the most abundant sources of data for establishing damage functions are insurers’ in-house “loss data.” Described by one cat modeler as “insurers’ own version of ‘big data,’” loss data arrives in a steady stream after a disaster when homeowners and small businesses make claims against their policies, adjustors descend to determine the veracity of the claims, and the scope of insurers’ losses begins to materialize.¹² By comparing exposure data (primary and secondary characteristics) and loss data (what actually happened), insurers can correlate information about the properties in their portfolio and the actual amount of damage, per property type, caused by a disaster event. The differences in what the models predicted and what actually happened provides new opportunities for further fine-tuning damage functions.

Building Codes and the Quality Conundrum

Other challenges exist for estimating vulnerabilities. The built environment is not static, and social responses to vulnerability influence and change the behavior of structures overtime. These changes are frequently bound up in efforts to improve what are known as buildings codes: local rules for minimum construction standards that developers and contractors must follow to receive a permit to build.¹³ Experience has shown that codes are often imperfectly implemented, meaning that codes themselves cannot be taken for granted. Building codes are therefore a major confounding factor for modelers in terms of making assumptions about an underwritten property’s exposure.

As a result, modelers have introduced assessments of the robustness of building code *enforcement* into their models. Verisk Analytics, the parent company of major cat modeler Applied Insurance Research (AIR), has a subsidiary company that maintains the Building Code Effectiveness Grading Schedule (BCEGS), which ranks many communities in America on a scale of one to ten to determine how well they implement the building codes on their books.¹⁴ Better ranking creates insurance discounts, whereas poor ranking gives modelers a justification to handicap their models, weighing damage ratios above what the building code would normally imply to reflect the lack of quality control.

The inability to take building standards for granted is only one obdurate link in a chain of difficulties facing modelers in their attempts to virtualize the built environment. Poor exposure data is another source of resistance in accurately estimating potential damages. Primary characteristics for a single building, or a whole set of buildings in an insurer's portfolio, might be coded incorrectly or be simply unknown. There is no central government repository in which this information resides. Modelers frequently receive their data from their clients (insurance companies) and insurance companies often gather data from their agents or customers. It is hard to standardize such a dispersed, ad hoc process of data collection, and modelers are often forced to populate their data tables with stand-in variables for unknown characteristics. These false, or fictional, numbers, are essential for formal calculation processes, but they may under- (and more likely *over-*) represent actual vulnerabilities.¹⁵

Previously, these persistent data difficulties were too daunting and labor intensive to rectify, so modelers just lived with them. But now, as cheap technologies for producing imagery of building structures become more available, there is opportunity to start filling these holes through the comprehensive collection of exposure data. Seeking more knowledge about "elements-at-risk" has also become a good business argument for managing the erosion of model accuracy due to shifting climate patterns. Finally, true to the spirit of "surveillance capitalism," companies are banking on the fact that this extra private property data carries value that goes beyond its use in improving damage functions. The more comprehensive the data, the greater the value.

Comprehensiveness

From insurers' perspectives, making data comprehensive involves enhancing information about their exposure to loss. Exposure is the information that insurers—not just property insurers, but all insurers—require a prospective policyholder to share about the underlying risk for which insurance is being sought. Exposure is pre-existing health conditions, the age of the driver, an individual's smoking habits, and the structural design of a building. It is the information that helps an insurer determine how much premium they are going to charge to underwrite a risk. Comprehensiveness, as a commercial imperative, targets exposure by leveraging the explosion of continuous, real-time, risk-relevant customer data that is becoming available in nearly every branch of insurance, from medical and health insurance to auto and life insurance.¹⁶

In the auto sector, for instance, insurers now offer pay-as-you-drive insurance. Individuals willing to share odometer data

can receive reductions in their insurance by showing that they drive less than average, and thus pose less of a risk of causing or suffering an accident.¹⁷ Auto insurers are exploring even more personally tailored insurance based on actual driving behavior. Some companies are offering reductions to drivers willing to install monitoring devices in their car that upload a constant stream of telematic data tracking when drivers accelerate rapidly, brake suddenly, turn a hard corner, or even take their eyes off the road.¹⁸ In the health sector, similar innovations are afoot. Insurers are exploring providing willing customers savings on their insurance if they link fitness-trackers like Fitbits or apps like Strava to measure behavior and commitments to healthiness that might differentiate an individual's risk of, say, cardiac arrest from the rest of the population.¹⁹

This same trend of comprehensiveness, and its underlying economic argument, is also affecting property and casualty insurance. The idea that better data leads to better pricing is a hard rationale for cat modelers to ignore. As Mahmud Khater, Chief Technology Officer (CTO) of CoreLogic, a cat modeling and property data company, explains:

If you actually start with the uncertainty in the [cat] models, the highest uncertainty exists in exposure for any insurance company or reinsurance company. So, when we do the modeling without this kind of information, we have to make assumptions. Making assumptions means uncertainty, but there's all this good data ... that would allow us to eliminate most of this uncertainty. It would allow us to know what kind of buildings are there, and then use them to really quantify the value of the buildings, and use that in the [insurance] process.²⁰

“All this good data” refers to new, “secondary” sources of data that go beyond the typical set of “primary characteristics” (occupancy, construction type, height, age) that cat modelers currently use for risk estimation. Higher resolution information can have a major influence on assessing the replacement cost value of a home, the base metric used for setting homeowner insurance premiums. For residential property, expanded secondary characteristics include information on roofs, pools, and other adjacent structures, and interior content such as marble or granite countertops and wood floors. In high wind areas, for instance, hip roofs (roofs that slope down on all sides of a house) withstand hurricane winds much better than gabled roofs (the typical A-frame-looking roof), and metal roofs tend to remain affixed better than clay-tile roofs (and cause less damage to other surrounding structures). This information is currently not included in most

cat models, but gives insurers a much better idea of the kind of damage a particular home might suffer in a hurricane compared to a neighbor's home.

Bringing data on “secondary characteristics” into a cat modelers’ building exposure databases has until recently been cost prohibitive. Its collection is difficult to automate, and requires on-site visits by real people with clipboard and pen in hand. Inspections aimed at gathering secondary building characteristics are typically only done for large commercial property holders.²¹ Yet from an insurer’s perspective, residential structures are what account for the majority of losses in catastrophes such as hurricanes. Only in the past half-decade has collecting this kind of information on private dwellings become cheap enough to turn into a line item for cat modeling companies. The rapid commercialization of web-scraping technologies that can tap into realtor websites, and drones capable of surveying buildings from above, has brought new species of big data into contact with cat modelers’ exposure databases.

Mowing the Sky

Verisk Analytic’s strategy to improve the predictive capacity of their damage functions is tied to their investment in an aerial imagery subsidiary called Geomni. While greater information currently exists for the secondary characteristics of commercial buildings, commercial buildings are actually more idiosyncratic than residential structures. Produced in volume, residential structures follow a relatively limited set of designs. And one of their most vulnerable components—their roofs—are visible from above. Getting better information about roofs is a priority for the industry, where current studies estimate that miscategorization of roof age alone costs insurers over \$1 billion annually in overwritten policies.²²

Geomni operates a fleet of around one hundred fixed-wing aircraft and unmanned aerial vehicles that conduct systematic scans of all the property in a given territory, providing high-resolution oblique and orthogonal imagery refreshed between one to three times a year for every corner of the continental US.²³ By “mowing the sky,” as a senior catastrophe modeling executive described it, the company develops multiple perspectives on the same property. It can then be modelled volumetrically using photogrammetry, which matches pixels in an image to the object in the real world (say roof type and texture), and subjected to machine learning, which improves the algorithms over time as the image base grows. This data is combined with other information about the built environment and fed into a cat model for a “true ground reality.”²⁴

Aerial imagery can be used by cat modelers to: 1) determine to what extent an insurers' exposure data matches the imagery of the buildings they're underwriting; 2) mitigate moral hazard by turning to machine learning, and thus reduce the need of insurance companies to rely on homeowners for information about their property; and 3) provide more stability to risk assessment by cat models (i.e., to augment the overall property exposure databases).²⁵

The business proposition, according to Verisk, is to create a unique repository for data on secondary building characteristics that insurers "can use ... to accurately understand growth and change, determine damage, discover hazards, assess risk, and perform valuations."²⁶ The company collects information on building footprints, roof shapes, roof types, roof slopes, swimming pools, outbuildings, percentage of tree cover, and more. Additionally, the company can deploy its aircraft within forty-eight hours of when a disaster occurs to conduct pre- and postnatural disaster image processing. This can provide an augmented version of the on-the-ground "damage survey," which in turn can feed back into improving damage functions and estimates of vulnerability.

The Complete View of Property[®]

While Geomni focuses particularly on the exteriors of structures to improve risk estimates, other competitors are collecting, aggregating, and modeling information about the interiors of homes and packaging this data for actuaries. CoreLogic, another major cat modeler, is also a provider of property information and analytics to the mortgage and real estate sectors. It was founded particularly to assist mortgage lenders in preventing borrower fraud and managing collateral risks, such as natural hazards, to underlying property assets. CoreLogic's Structural Risk and Valuation unit has developed an approach marketed as the Complete View of Property[®] that combines hundreds of sources of data to generate detailed information about both the exterior characteristics of a building and its interior components.

A major difference from Verisk's efforts to "mow the sky" is CoreLogic's efforts to estimate building contents (i.e., the kind of building materials and goods inside of a home). This is an incredibly difficult process that has been almost wholly dependent on information provided by individual homeowners or home assessors. Yet, as a property transaction company, CoreLogic builds products for the real estate sector, including a software platform that hosts Multiple Listing Services (MLS). MLS systems are the backbone of local real estate markets, allowing brokers within the same territory to access other brokers' listings, thus matching buyers and sellers

while providing each broker a commission from any sales jointly arranged. Hundreds of MLS systems have been set up by local realtor associations in the US, and CoreLogic has become a major provider for hosting MLS transactions.

In exchange for their services, CoreLogic secures license rights to some of the data stored on these platforms, including photos of listed properties. Thanks to these agreements, according to the group's marketing pamphlets on their website:

Insurers now have a virtual window into a home and can easily validate property characteristics without leaving their desks. For underwriters and agents, this means increased efficiency at point-of-sale and happier homeowners since they no longer have to answer a seemingly endless string of questions about their home... With an average of 13 interior and exterior photos per residential address, [CoreLogic] will help you identify hidden risks such as an in-ground pool that isn't fenced, distressed properties, or obvious code violations.²⁷

The company advertises that property photos provided by MLS can be combined with research correlating "more than 100,000 construction line items and 90 labor trades as well as construction crew sizes, productivity, soft costs and code variations," title transfer, foreclosure information, public tax assessor records, and work permits, all which serve to track when upgrades and restorations are made to specific properties.²⁸ This dizzying amount of information is directed at reducing overall model uncertainty and allowing the company to claim that their estimates of replacement cost are more current and up-to-date than those of their competitors. The purportedly "happier homeowner" is juxtaposed against the interests of insurance companies, who can now more easily reject claims because their customers fail to maintain their property or can be shown to have violated local building codes, wittingly or not.

Conclusion

The influence of climate change on natural hazards is introducing new uncertainties into calculating insurance risks.²⁹ Understanding natural hazards, however, is only one component of accurately forecasting catastrophe loss. Social norms such as building codes and other efforts to mitigate risks have a major influence on how a disaster unfolds in time and space. Yet the social world is never "finished," and so it remains hard to model the changes in social structures. One response to the obstacles of accurately simulating future

states is to reduce uncertainty in exposure data by exhaustively documenting the existing built environment.

Accumulating data about homes and buildings deepens the predictive variables in risk assessors' exposure databases. It can reduce the time it takes for an insurer to adjust a claim after a disaster and make the allocation of company resources more efficient during the crucial early part of a recovery.³⁰ It may even strengthen arguments for better building code enforcements and increased public expenditure on risk mitigation. Yet, it also represents a potentially invasive breach of privacy. The imagery from above, the photo from within—the customer has no idea these interventions have taken place. How does a homeowner gain a sense of the role intimate spatial images play in the availability or affordability of their insurance? Is fraud detection a secondary, or primary service? Do premiums only go up, or do corporate savings from increased efficiencies also translate into more affordable insurance?

Additionally, while these innovations may be justified to improve loss estimate algorithms, what else might they be used for? As Todd Stennett, a Geomni executive, put it at a trade fair in 2018: "We are looking for folks who are interested in working [this] data into all other end user applications outside of insurance and we've got pretty much a whiteboard; we can work with you to write some numbers that would make sense ... and help you make more money and help us monetize this content into other vertical markets."³¹ In the logic of surveillance capitalism, these companies would be negligent if they *did not* try and convert comprehensiveness into new and unforeseen revenue streams. Data accumulation becomes its own rationale. But what, or who, governs the collection and sharing of this data?³²

Catastrophe models are important tools that have helped stabilize insurance markets in the face of changing natural disasters. The main purpose of the models, as one of the head engineers at the modeling firm AIR puts it, "is not to predict losses at a location for a given event, but to provide reliable estimates of potential losses to portfolios of properties ... and to effectively differentiate the vulnerability of properties in different regions."³³ By increasing the resolution on individually coded, periodically updated identifiers for each property in an insurer's portfolio, cat modelers are expanding techniques of differentiation, while also heightening lived experiences of difference. Whether comprehensiveness will help enhance resilience to disasters without introducing new algorithmically encoded social disparities, however, remains an open question.

- 1 Simply put, uninsurable projects go unbuilt. Banks will not finance a mortgage nor lend money to an industrial facility if the prospective homeowner or business cannot secure insurance. On the flip side, insurers also encourage risk mitigation, something seen in the industry's role in the development of early building codes as a means for managing urban fire risks. Sprinkler systems, fire escapes, and inflammable building materials all grew from investments by insurers. These twin logics of loss speculation and loss prevention are integral to the sector's model of capital accumulation.
- 2 Since 1900, for instance, there have been less than two landfalling hurricane per year on average in the continental United States—not really a time series that lends itself to robust statistical analysis. This absence of loss data is what the models solve.
- 3 Damian Carrington, "Climate Change Threatens Ability of Insurers to Manage Risk," *The Guardian*, December 7, 2016. A growing body of science attributes worsening storms to the warming of the climate. See Adam H. Sobel, Suzana J. Camargo, Timothy M. Hall, Chia-Ying Lee, Michael K. Tippett, and Allison A. Wing, "Human Influence on Tropical Cyclone Intensity." *Science* 353, issue 6296 (July 2016): 242–46. The trend is expected to become more severe as anthropogenic change accelerates. See H. Murakami, E. Levin, T. L. Delworth, R. Gudgel, and P.-C. Hsu, "Dominant Effect of Relative Tropical Atlantic Warming on Major Hurricane Occurrence," *Science* 362, issue 6416 (November 2018): 794–799.
- 4 Paige St. John, "Creating an \$82 billion threat: the formula: a hotel room, four hours and a dubious hurricane computer model," *Sarasota Herald-Tribune*, November 14, 2010.
- 5 See Marion Fourcade and Kieran Healy, "Classification Situations: Life-Chances in the Neoliberal Era." *Accounting, Organizations and Society* 38, no. 8 (November 2013): 559–72; Eric Siegel, *Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die*, (Hoboken, NJ: Wiley, 2016); Zeynep Tufekci, "Algorithmic Harms beyond Facebook and Google: Emergent Challenges of Computational Agency," *Colorado Technology Law Journal* 13 (2015): 203.
- 6 Shoshana, Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: Public Affairs, 2019). According to Zuboff's critique, surveillance capital, as epitomized by companies such as Google or Facebook, is premised on the exploitation of surplus personal data which the companies collect by monitoring user behavior on their services. This surplus data (frequently called "data exhaust" in the industry), which remains unknown and completely invisible to the user, can be packaged and sold to other parties, thus creating new value streams for the surveillance capitalist.
- 7 There have traditionally been three major cat modeling firms globally: Risk Management Solutions (RMS), Applied Insurance Research (AIR), and EQECat (now called CoreLogic). RMS and AIR currently dominate the field, although a host of new weather and climate risk analytics firms such as Jupiter Intelligence, One Concern, and Four Twenty Seven are increasingly competing in this space.
- 8 Don G. Friedman, "Natural Hazard Risk Assessment for an Insurance Program," *The Geneva Papers on Risk and Insurance* 9, no. 30 (January 1984): 57–128.
- 9 Patricia Grossi and Howard Kunreuther, ed., *Catastrophe Modeling: A New Approach to Managing Risk* (Berlin: Springer Science & Business Media, 2005).
- 10 Don G. Friedman, 55.
- 11 Barry Gilway, "Citizens Property Insurance Corporation." (CEO of Citizens Property presentation to the US Department of Treasury Advisory Committee on Risk-Sharing Mechanisms (ACRSM), July 28, 2017).
- 12 Karen Clark, "Big Data Analytics: Mining Your Catastrophe Claims Data for Competitive Advantage," *Carrier Management*, July 20, 2016. This is not "big data" on the order of daily tweets or Facebook hits, but big in terms of the amount of information encoded with each claim. In 2017, for the entire US, according to the National Bureau for Economic Research, there were over five million individual catastrophe claims with private insurers (catastrophes defined as events causing over \$25 million in losses for the insurance sector).
- 13 Not only do rules for building design change, but so do institutional responses to natural disasters. When estimating the postdisaster replacement cost value of a home, modelers now anticipate nonlinear social factors such as community investment in disaster preparedness (i.e., pump stations, rapid response teams), demand surge on construction materials, tightening labor markets under times of crisis, and even looting, among other factors. They build these factors into their risk assessments (thereby adding justifications for higher premium rates to meet these modeled contingencies).
- 14 The BCEGS sends teams to communities to assess numerous factors of "enforcement," including how many people a city's inspection

- department employs, whether the city planning office has specific rules governing constructing for natural hazards, who licenses building contractors within a community's jurisdiction, and so on.
- 15 Martha Lampland, "False Numbers as Formalizing Practices," *Social Studies of Science* 40, no.3 (June 2010):377–404. Paige St. John, "Hurricane models: garbage in, gospel out: In secret calculations, a stew of flawed data," *Sarasota Herald-Tribune*, November 15, 2010.
 - 16 See Marine Corlosquet-Habart and Jacques Janssen, ed., *Big Data for Insurance Companies* (Hoboken, NJ: Wiley-ISTE, 2018); Tony Boobier, *Analytics for Insurance: The Real Business of Big Data* (Hoboken, NJ: Wiley, 2016).
 - 17 See Evan Mills, "The Greening of Insurance." *Science* 338, issue 6113 (December 2012):1424–25; Dimitrios I. Tselentis, George Yannis, and Eleni I. Vlahogianni, "Innovative Insurance Schemes: Pay as/How You Drive," *Transportation Research Procedia* 14 (April 2016): 362–71.
 - 18 See Lacie Glover, "3 Ways Car Insurers Use Technology to Monitor Driving and Offer Discounts," *Chicago Tribune*, July 31, 2018; Dimitris Karapiperis, Birny Birnbaum, Aaron Brandenburg, Sandra Castagna, Allen Greenberg, Robin Harbage, and Anne Obersteadt, "Usage-Based Insurance and Vehicle Telematics: Insurance Market and Regulatory Implications (Center for Insurance Policy and Research, 2015).
 - 19 Suzanne Barlyn, "Strap on the Fitbit: John Hancock to Sell Only Interactive Life," *Reuters*, September 19, 2018; Bernard Marr, "How Big Data Is Changing Insurance Forever," *Forbes*, December 16, 2015.
 - 20 Charles E. Boyle, "CoreLogic: Taking Big Data Analytics to New Customers and Consumers," *Insurance Journal*, December 2, 2014.
 - 21 Large private property owners will hire building inspectors to gather secondary characteristics in order to reduce their insurance premiums. In a big portfolio of properties, perhaps only a handful of buildings will account for a large percentage of the modeled risk estimates, and a company seeking insurance can sometimes drive down the price of their insurance by gathering more bespoke data showing that the one or two large buildings (say warehouses with inventory, or crucial manufacturing structures) that account for most of their loss estimates are less risky than suggested by the models.
 - 22 Joseph Emison and Holly Tachovsky, "A National Loss Study: The Billion Dollar Impact of Underestimated Roof Age," *Claims Journal*, October 3, 2014. This estimate does not account for lack of knowledge about roof structures and building materials.
 - 23 While the market in the US is further advanced than anywhere else, Verisk recently acquired UK-based aerial imagery company Geoinformation Group in 2016 to build up equivalent property imagery capacity in Europe.
 - 24 Author interview with senior cat modeling executive, June 29, 2018.
 - 25 As one modeling executive told me, "Because it's a lot of investment on an insurance company's part to collect this (secondary) information. Do you just believe the homeowner when he gives you this information? Because he might lie to get his premium reduced, so you might have to send out someone to inspect it right? But this is money." Interview with the author, December 14, 2018.
 - 26 Verisk, "Verisk Announces Important Remote Sensing Capabilities in Its Geomni Business," press release, August 1, 2017.
 - 27 CoreLogic, "Risk Evaluation Solutions," retrieved June 23, 2021.
 - 28 Ibid.
 - 29 Bradley Hope and Nicole Friedman, "A Hotter Planet Reprices Risk Around the World," *Wall Street Journal*, October 3, 2018.
 - 30 Denny Jacob, "Managing claims in a changing climate," *Property and Casualty* 360, January 7, 2020.
 - 31 Todd Stennett interviewed at the 2018 SPAR3D Expo and Conference in Anaheim, CA, June 3–5, 2018. Point of Beginning (POB), "Get to Know Geomni," YouTube, September 7, 2018.
 - 32 According to Shoshana Zuboff the crucial questions should be asked of companies that surreptitiously collect and exploit user data for profit are: "Who decides how the data is used? And who decides who gets to decide how it is used?" Zuboff, 176–198.
 - 33 Karthik Ramanathan, "Modeling Fundamentals—Anatomy of a Damage Function." *AIR Currents*, April 24, 2017.

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Anthropocene Hubris

Stephanie Wakefield

Precarious Entanglement

During the Anthropocene—the current terminal period of neoliberal capitalism marked by climate change, environmental degradation, and sociopolitical unraveling—calls to rethink human life abound. In response, a powerful subframe of Anthropocene theory—what we might name “precarious entanglement” or “dwelling in the ruins” thinking—forwards one way of doing so. For proponents of this perspective, the infrastructures, promises, and aspirations of modernity are seen as ruins themselves.¹ To think otherwise would be to miss the lessons the Anthropocene holds for us: modern humanism and attendant ideas of progress, hubris, and freedom were an error, and now drive current devastation. Humanity must, this narrative insists powerfully, be humble.

“No more agents of history. We all agree on that,” argues sociologist Bruno Latour, whose work perhaps most fully fleshes out this narrative.² Reversing the modern story of human freedom as a matter of rising above, separating from, or hubristically trying to transform the world, this line of Anthropocene thinking argues its inverse: that subjection to volatile earth forces and entanglement amidst ruins are the real nature of human existence. This entanglement in social-ecological-technological relations, once elided by modern thinking, is not to be escaped but to be embraced, argues philosopher Timothy Morton; such loops, he maintains, are our “fate” and “destiny.”³ Seeing ourselves within complex systems to which we are bound reveals that rather than makers of worlds, we are defined by precarity. Instead of holding on to hope or dreams of a “happy ending” we must now learn to survive, to use anthropologist Anna Tsing’s terminology, “in capitalist ruins.”⁴ The perfect image of our new earthbound existence, Latour says, is the brutal ending to Béla Tarr’s film *The Turin Horse*:

In the final tempest of the last days of Earth, father and daughter decide to flee their miserable shack isolated in the middle of a desperately parched landscape. With a sigh of relief, the spectator sees them finally going away, expecting that they have at least a chance of escaping their diet of one potato a day. But then, through a reversal that is the most damning sign of our time, a reversal that I don’t think any other film has dared show, instead of moving *forward* to another land, one of opportunity, full of great expectations, full of hopes (remember *America America*), we see with horror that they come back, exhausted, despondent, bound to their shack, resuming their old even more miserable life until eventually darkness envelops them in its shroud.⁵

This reading of the Anthropocene, political theorist David Chandler argues, is itself “increasingly affirmed as a positive and enabling opportunity” to overcome modernist frameworks and embrace the actual nature of life: precarious survival amidst entangled ruins.⁶ What is affirmed is that the apocalypse is capitalism at present, the very conditions that define the Anthropocene. In making explicit what is often implicit in neoliberal governance approaches—forwarding images of life as insecure, apolitical, and hostage to volatile systems—precarity-entanglement theory limits itself to thinking through what exists rather than exploring ways to refuse or change it.⁷ Works in this vein frequently deploy a universalizing “we” whose sins and pride have brought on the Anthropocene.⁸ The wreck of the good life, the postwar period of high consumption and high wages in the West, is normativized and deployed as an effigy of excess, rather than what it was: a brief postwar apparatus, which resulted from pitched workers’ struggles in the twentieth century, and that was ultimately tenuous and uneven. Described in dramatic prose is a new “we” of the Anthropocene that will wander in the wastelands, embracing its precarious and diminished existence, much akin to the life many of us are already living in the early twenty-first century. In a conservative move, this narrative is abdicating human agency, experimentation, and radical challenges to the social order in the name of accepting “our” fate. But, as systems technology analyst Venkatesh Rao stated on Twitter in 2019:

It’s funny how people think a post-apocalyptic landscape will be relatively flat socioeconomically. At most they think there will be small-scale warlords or Dunbar-scale anarchist communes. No. There will be deathstar billionaires with private armies and narrow-deep tech stacks.⁹

Constraining human being to the *is*—precarious survival amidst entangled ruins—rather than the possible contributes, intentionally or not, to the already omnipresent sense that what already *is* is all that is possible, and renounces hubris and audacity at a moment when poor and working-class people seriously need these qualities.

Disentanglement and Delinking

Ultimately, this particular version of Anthropocene thinking fails to capture many of the characteristics and possibilities of the present. By this I do not mean that the current moment is not marked by entanglement. On the contrary, defining and administering life cybernetically in terms of information, feedback, and non-equilibrium interconnection—dismantling the modern

subject—has been central to Western neoliberal governance for decades.¹⁰ Post–September 11, securing interconnected critical networks came to be seen as especially paramount, with American military analysts like Thomas Barnett dividing the world into a “functioning core” and a “non-integrating gap,” the latter defined as “disconnected from the global economy and the rule sets that define its stability.”¹¹ “Eradicating disconnectedness,” argued Barnett in his much-discussed *The Pentagon’s New Map*, “therefore becomes the defining security task of our age”¹² with failure or refusal to integrate into the global economy and its rule sets enforceable by military action.

From Lagos to New York, urban planners and governments have more recently emphasized connectedness as key to building resilience to climate change and its effects.¹³ Originating in cybernetics and ecology in the 1970s, resilience is both an ontology and design practice based in systems thinking, which emphasizes the interconnectedness of the social, ecological, and technological.¹⁴ Whereas modern forms of administration were based in binaries between cities and nature and sought to eliminate volatility and risk, resilience is a governance paradigm that welcomes entanglements, understands instability as inevitable, and views cities as coupled social-ecological-technical infrastructural systems that must develop their capacity for absorbing turbulence.¹⁵ In resilience approaches, entanglement is thus viewed not only as politically mandatory (as for early 2000s geopolitics) but also ontologically natural: a corrective to erroneous modern ways of thinking.

However, while entanglement is increasingly celebrated, we are also witness to some of its opposites. In the United States, one might observe that there seems to be growing tendency toward “delinking” or “islandization” in response to Anthropocene conditions and events. For example, politicians promote ever-more securitized borders and walls as a manipulative solution to the suffering of working-class people. The very wealthy detach their stacks and supply chains, shore up urban networks against climate change, or disconnect from the same social media they own, while also preparing infrastructure for bigger moves in the future to secure themselves and their forms of life. This may be seen as the Anthropocenization of what historian Nils Gilman calls the plutocratic insurgency that has been underway for decades: a revolt by capitalist elites against the confines of modern postwar territorial power configurations.¹⁶ In this insurgency, the rich seek to detach themselves legally and infrastructurally from what Gilman terms “social modernism”: an ideological and institutional formation centered around the nation state as a provider of welfare and economic growth.

Along with off-shore tax havens, Fourth Industrial Revolution modes of labor management, and gutting the West’s working-class

and welfarist structures, a key component of the plutocratic insurgency is the creation of enclaves like those documented by Mike Davis.¹⁷ “These islands of elitism,” explains Gilman, “are designed to be largely self-sufficient in their ability to deliver health care, food, security, education, entertainment, etc. to their residents, even as they sit amid seas of social misery... From the point of view of the denizens of such communities, the primary function of the wider society is to serve as a source of cheap, servile labor, and as a well of resources to be looted.”¹⁸ But gated communities, Gilman further argues, “are merely an example of a broader pattern, in which economic, social, or political enclaves are carved out of a national state and enabled to play by a fundamentally different set of rules from the surrounding territory.”¹⁹ Taking this forward, Kanye West recently floated “building a fireproof community” after he and Kim Kardashian hired private firefighters to save their \$60 million California mansion during the 2018 California wildfires. Meanwhile, the Seasteading Institute, founded by Milton Friedman’s grandson and originally funded by Peter Thiel, is exploring how to set off a “Cambrian explosion” of autonomous artificial floating cities starting in the Pacific Ocean. In the Institute’s eyes, seasteads are a solution to sea rise as well as what they see as the domineering overreach (read: taxation) by existing governments—a way to “liberate humanity from politicians.”²⁰

These earth governance efforts exist alongside private space colonization projects couched as an escape hatch from an increasingly degraded earth.²¹ Elon Musk has built and successfully tested rockets with which SpaceX intends to send humans to Mars by the mid-2020s (NASA plans to land astronauts there by 2033) and predicts beginning colonization as early as 2025. Most left commentators cynically scorn such space ventures,²² but it is understandable how others might regard them as a worthy human venture, one that current and future generations might find actually desirable, not least because it might offer escape from the social carnage of neoliberalism’s cataclysmic continuation on earth. There is nothing necessarily wrong with imagining oneself in the shoes of the first humans to see Mars’s surface with their own eyes, descending from a rocket doorway to touch the planet’s rocky red crust with their own feet. Just like the writings of science fiction author Steven Erikson, commercial space ventures contain their own poetics: the desire to go where no human has gone before, find other life, or sink into the stars at warp speed.²³

In the more pragmatic vision of the world’s on-and-off wealthiest person and *Star Trek* fanatic Jeff Bezos, the only way for poor and working-class people to get to space will probably be as free labor in one form or another. As Bezos recently described, with resources on earth running out, “space is the only way to go.” Rather than colonizing Mars, though, Bezos plans to build artificial

worlds—O’Neill cylinders rotating to create artificial gravity—orbiting Earth and able to support one million people each. Some of the cylinders will be agricultural areas irrigated by drones, while some will be cities and others more recreational.

“What does architecture even look like when it no longer has its primary purpose of shelter?” asks Fred Scharmen.²⁴ Like “Maui on its best day, all year long. No rain, no storms, no earthquakes,” Bezos responds. Earth, he envisions, will be rezoned as a residential and light industrial zone.²⁵ “We send things up into space but they are all made on Earth. Eventually it will be much cheaper and simpler to make really complicated things, like microprocessors and everything, in space and then send those highly complex manufactured objects back down to Earth, so that we don’t have the big factories and pollution generating industries that make those things now on Earth.” And as to the question of “who is going to do this work?” Bezos concluded: “not me,” and gestured to a group of school children in the audience wearing shirts from the children’s club of his space company, Blue Origin. “You guys are going to do this, and your children are going to do this.”²⁶

Human Agency: A Slender Air-Bridge to the Possible

It is increasingly important to refute assertions—both those of governments and some critical theory narratives—that nothing else is possible. Both literally and figuratively, “this” world is actually not the only world there is. Much is actually possible. The first grunt labor force sent to Mars could blow up the return Starship™—gone Croatan, albeit on the red planet. Still, beyond contributing to the present shredding of the social fabric or desperately flinging oneself against it in vain, it can be extremely difficult to imagine what liberation in the Anthropocene might look like, especially for the poor and working class. To say anyone knows the answers to the unbelievably complex problem of contemporary neoliberal capitalist society would be disingenuous. To say that a preidentified system would provide a better world seems even more off, especially considering the outcomes of such projects throughout the twentieth century. We cannot imagine what we cannot imagine. If the emergence of the Anthropocene tells us anything, it is that we need a break with existing structures and institutions and ways of thinking, perhaps including ones that have risen so recently to hegemony in the epoch’s name.

This need for a break is widely felt. Eco-cybernetic entanglement, precarity, and lack of agency are circumstances in which much of the population lives and not by choice. Rather than celebrating Anthropocene conditions, it is worth seriously considering that an equally descriptive image of the present is that of the current

order's structures on fire. This zeitgeist was well-summarized in political scientists Michael Bang Petersen, Mathias Osmundsen, and Kevin Arceneaux's recent survey, covered by the *New York Times* with alarm, which reported highly affirmative responses to statements such as: "When I think about our political and social institutions, I cannot help thinking 'just let them all burn'" (forty percent agreed); "We cannot fix the problems in our social institutions, we need to tear them down and start over" (forty percent agreed).²⁷

This sentiment is part of the attraction many Americans have to apocalyptic movies and TV: the end promises an escape from the present order. Take, for example, the once extremely popular TV series *The Walking Dead*, which during its golden age—season four (2014)—was the most popular show for Americans aged eighteen to forty-nine (15.7 million people watched the season finale). The episode "Still" opens with a survival skills montage of characters Daryl Dixon (grizzled crossbow-toting fan favorite whose face is featured on "Don't Mess with Daryl Dixon" T-shirts sold at Walmart) and Beth Greene (blonde, Christian, suburban) collecting tools, trapping animals, and roasting snake. Devastated by the recent murder of Beth's father and loss of their band of companions, the pair wander a zombie-ravaged landscape. Inside an abandoned country club where they search for bottles of liquor, Daryl discovers piles of money. Falling to his knees, he shovels the bills into a duffel bag, frantically acting on old impulses. Later, they hole up in an abandoned rural house. Car parts and old tires litter the yard. Inside, cigarette butts overflow on plates atop a junk store kitchen table. On the porch they drink their found moonshine and share stories from their pasts (while Beth's sheltered upbringing is known, Daryl's "before" story has until this episode remained unknown).

"Home sweet home," says Daryl, reminiscing to Beth about how he grew up in a house just like this. He recounts how his abusive, racist father would place jumbo, plastic, bra-shaped ashtrays on the TV and use them for target practice, sitting in his underwear drinking in a camouflage La-Z-Boy. "You want to know what I was before?" he asks Beth. "I was nobody. Nothing. Some redneck asshole." "I'm just used to it, things being ugly. Growing up in a place like this." "We should burn it down," Beth suggests. Beth too has experienced great pain and loss and is ready to leave the past behind in her own way. They gather the money they'd hoarded—valueless now anyway—and the alcohol with which they'd tried to drown their pain and use them as tinder and fuel to burn the house down. In an extraordinarily beautiful scene—which reverses Latour's *Turin Horse*-inspired vision—Beth and Daryl, their faces lit up by flames, point their middle fingers at the ruined house, turn their backs and walk into the night.

It's not that a better world awaits ahead, nor that the scene is triumphant. But to paraphrase Beth, at least you're not living how you used to, not anymore. This version of the apocalyptic is powerful and popular because it offers a way out of the crushing hopelessness and impossibility of becoming something or someone else that many poor and working-class people in America feel. Or at bare minimum, a proper response to the structures that create these conditions.

Daryl's past—represented by the dilapidated manufactured home—offers an image of rural poverty across the American hinterlands, where unemployment and debt are extraordinarily high and “deaths of despair” (suicide, drug overdose, alcoholism) are common.²⁸ Far from the spaces of academic theorizing, such “ruined” places represent the much broader death of the so-called American dream, the sum of the post-1970s decades of revanchism and counterrevolution waged via deindustrialization, wage cuts, urban crackdowns, hyperincarceration—all strategies flanked by a massively increased wealth gap and soaring profits for the very wealthy, now augmented by ecosystemic collapse. Daryl and Beth's story embodies a fictional response to a certain experience of this. But such imaginaries only echo larger-scale, real world responses to other, differently situated experiences which have been launched in recent years from America's impoverished cities and suburbs—such as Ferguson, Missouri—by humans sick of being dehumanized by the never-ending police shootings of African Americans, ghettoization, and economic precarity.²⁹

In spite of theoretical prescriptions to the contrary, we need ways to pry open the walls closing in around us (walls around the imagination, walls between the now and the future, between peoples). Toward this end, Alfredo Bonanno once described insurrection as an air-bridge to the unknown, a non-rational breaking through the structures of the present—wage work, for instance—to a space of the possible in which we might see in new ways. “A slender air-bridge between the tools of the past and the dimensions of the future.”³⁰ Rather than celebrating the ruins or qualities of entanglement and precarity imposed by governments and companies, perhaps building these air-bridges might have something to do with delinking. This can mean detaching, as theorist Eva Haifa Giraud suggests, from structures and situations which strangle us, to reweave others, according to other priorities.³¹ Perhaps delinking as a liberatory—not resentful or conservative—political matter will also involve both reconsidering what building power today means and working towards freedom as a serious and urgent goal, even (and especially) as the old orders shred themselves apart.

Here we might note, in America at least, the growing normalization of once-outlier activities amongst growing numbers of working-class individuals and families. Examples of this include learning

survival skills, building local infrastructures (wireless mesh networks, food production, whether farming or engineering protein bars, etc.), and taking up physical fitness regimes.³² Such activities are representative of an increasingly widespread desire to decrease dependency and take back some degree of power over one's life and abilities—to reappropriate one's means of existence, even if the only time to do so is found during lunch breaks. Yet placed alongside the scale, vision, and material means of delinking activities of the world's very wealthy and the force they mobilize, these scattered efforts too often seem to reflect a *powerlessness*—an inability to build real power or autonomy—rather than the opposite.

Life exigencies and lack of resources often mean that, at best, such practices result in an increased preparedness to survive the next Coronavirus or hurricane (no minor feat of course), during a time when the definition and horizon of life has become “normalizing survival.”³³ Still, even prepping is often animated by important questions such as how to help oneself and others and how to not be hostage to relief agencies, FEMA camps, or governments that disdain whole populations. How to save your family from sleeping on a gym floor, like the Kims in Bong Joon-ho's *Parasite*? How not to allow oneself to be reduced to scrounging for the last can of beans at the panic-ravaged grocery store? How to take care of oneself and one's own communities—the things and beings you love? Such questions are a pragmatic and existential matter of refusing to be dependent on corporations and algorithms. Addressing them also opens up much broader horizons.

As the Anthropocene progresses, will emancipatory trajectories of delinking take shape at a comparative scale and depth of power to those of the planet's ruling classes? Will the epoch be marked by a widespread movement of peoples delinking from dehumanizing structures to create other, rich, unbounded territories, ones infrastructurally and subjectively capable of deciding how to live on their own terms? Using recent work by geographers on the concept, “territory” here might be thought of less in terms of a two-dimensional bounded area and instead as heterogenous, emergent assemblages on land or sea; powerful “volumina” made of their own technologies of living, ways of moving, geopowers, and relations with humans and nonhumans.³⁴ Although it is an antagonistic concept, “territory,” philosopher Elizabeth Grosz writes, is also “artistic, the consequence of love not war, of seduction not defense.”³⁵

It's impossible to know in advance whether this would lead to more livable futures. But surely exploring the possibility offers a more promising direction than affirming precarious entanglement and abdicating human hubris to the rich. Delinking and relinking on one's own terms are not techniques that conservative forces monopolize. However difficult it may be to explore this direction, given that

most lack a financial or territorial base to begin from, it seems crucial to build material power. But then again, maybe some Zoomer will say this is an antiquarian modality—that more power can be found enmeshed in ethereal flows accessible alone in one’s bedroom on a laptop (whether using Google or Tor). For some this might be unacceptable or at least not enough, but that doesn’t make it wrong.

Precarity-entanglement thinking recognizes something important about the Anthropocene: we require new ways of thinking and living. But the task of thought should never be to instruct others in how to live, to provide universals to define life, or to flank governmental assertions that “nothing else is possible” other than the resilient continuation of existing structures while the world burns and floods. Taking the claim that an old world is ending opens much broader horizons. The end of the “one-world world”³⁶—or what I call the Anthropocene’s “back loop”—is not the time for reasserting new universal definitions for what life should be, but for reaching out into the infinite range of what we and others might make it.³⁷ Just as scholars such as Clive Barnett and Stephen Collier have argued against reductive or ontologizing critiques of government, so too is there a need for critical Anthropocene thinking to resist this approach.³⁸

Acknowledging that the world is not there “for us” and that the earth has its own intractable forces and autonomy need not require as its corollary to sink into self-hatred or the disavowal of human capacities. Surely there are other possibilities beyond this false binary that some versions of Anthropocene thinking tether human being to. As Chandler suggests “perhaps it is a false and forced choice to choose between ‘the human’ and ‘the world’? Perhaps rethinking modernity does not necessarily involve the refutation of any possibility of political alternatives other than those based on accepting our newfound fragility and vulnerability?”³⁹

At a time when human power and hubris have become objects of disdain for some, it is important to insist on its critical importance in the Anthropocene. One could look back to a vast and varied range of hubristic human efforts, with some dominating nature or oppressing populations and others embodying collective struggles for freedom. But emancipatory struggle is not an object of remembrance. Rather, it is a basic human need elaborated in ever-new ways. Thus, it is fitting and appropriate that the 2010s opened and closed with global waves of anti-government uprisings (although resistance at the decade’s close was notably subdued in the US). What’s needed now is a hubris proper to both the Anthropocene and the subjects trying to escape from it. Without such a hubris, without the embrace of profound experimentation with existence, we cede the future and our lives to the billionaires and petty warlords, technocrats and politicians.

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- 2 Bruno Latour, Isabelle Stengers, Anna Tsing, and Nils Bubandt, "Anthropologists are Talking—About Capitalism, Ecology, and Apocalypse," *Ethnos* 83 no. 3 (April 2018): 587–606; Stephanie Wakefield, *Anthropocene Back Loop: Experimentation in Unsafe Operating Space* (London: Open Humanities Press, 2020).
- 3 Timothy Morton, *Dark Ecology: For a Logic of Future Coexistence* (New York: Columbia University Press, 2016).
- 4 Anna Tsing, *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University Press, 2016), 8.
- 5 Bruno Latour, "Facing Gaia: Six lectures on the political theology of nature," (Edinburgh: The Gifford Lectures on Natural Religion, February 18–28, 2013), 117–118
- 6 David Chandler, *Ontopolitics in the Anthropocene: An introduction to Mapping, Sensing and Hacking* (London: Routledge, 2018), xv.
- 7 Andreas Malm, *The Progress of this Storm: Nature and Society in a Warming World* (London and New York: Verso, 2018); Brad Evans and Julian Reid, *Resilient Life: The Art of Living Dangerously* (Cambridge, UK: Polity Press, 2014).
- 8 Scholars have criticized the Anthropocene extensively for its invocation of a single figure of Man (or Human or Anthropos), its erasure of race and gender difference, or its elision of the fact that the destruction now wrought by "humanity" is in fact caused by the actions of a very small percentage of wealthy people. See e.g., Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2019); Andreas Malm and Alf Hornborg, "A Geology of Mankind? A Critique of the Anthropocene Narrative," *The Anthropocene Review* 1, no. 1 (January 2014): 62–59.
- 9 Venkatesh Rao (@vgr). "It's funny how people think a post-apocalyptic landscape will be relatively flat ..." Twitter, October 5, 2019. While Rao holds a PhD in Aerospace Engineering and was previously a researcher at Xerox and Cornell, he currently works independently as a management consultant and writer, sharing analysis via his popular blog Ribbonfarm and on Twitter. While not a well-known theorist like Latour, Rao is one of a growing number of critical thinkers exploring the present in interesting ways outside the limits of traditional institutions.
- 10 Manuel Castells, *The Rise of the Network Society, The Information Age: Economy, Society and Culture Volume I* (Malden, MA and Oxford, UK: Blackwell, 2009).
- 11 Thomas P. M. Barnett, *The Pentagon's New Map: War and Peace in the Twenty-First Century* (New York: G.P. Putnam's Sons, 2004), 8.
- 12 Ibid, 8.
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- 16 Nils Gilman, "The Twilight of Social Modernism," in *Plutocratic Insurgency Reader*, ed. Robert Bunker and Pamela Ligouri Bunker (Bloomington: Xlibris, 2019), xix.
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- 24 Fred Scharmen, *Space Settlement* (New York: Columbia University Press, 2019). See also Felicity D. Scott, "Securing Adjustable Climate," in James Graham, Caitlin Blanchfield, Alissa Anderson, Jordan Carver, Jacob Moore (Eds.), *Climates: Architecture and the Planetary Imaginary* (New York: Columbia Books on Architecture and the City, Lars Müller Publishers, 2016): 90–105.
- 25 Marina Koren, "Jeff Bezos Has Plans to Extract the Moon's Water," *The Atlantic*, May 10, 2019.

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*Torrential Urbanism
and the Future Subjunctive*

Nashin Mahtani

Just as the fear of hell drives the marketing schemes of paradise, so too does the desire of paradise fuel the schemes of hell.

—Anna Tsing¹

Jakarta's reputation as the "fastest sinking city in the world" has drawn a frenzy of media documentation through the lens of climate change-driven doom. Reported through gargantuan and often condescending tones ("urbanization gone horribly, horribly wrong!"), these narratives appeal to media sensationalism while disregarding the tactical complexities of heterogenous political economies at play in the industries of climate speculation and aid.² The sinking of Jakarta cannot be considered separately from long histories of water privatization, (neo)colonial development projects, and the politics of trade and investment. Yet reductive media stories often resort to a moralization of the northern, flood-prone districts of the city and their inhabitants as destitute, irreparable, and disposable, failing to recognize the multitude of residents viscerally immersed and actively living in this torrential urbanism. While international journalists resort to inflammatory representations that perpetuate a stature of disposability and escapism, residents have forged unprecedented alliances, shared in the work of coproducing viable lives among these uncertain futures, and developed forms of collective calculus adequate to their nested and kaleidoscopic predicaments.

The risk of living in North Jakarta is real, even if it is unequally experienced, distributed, and perceived. The totalizing, apocalyptic narratives of imminent demise, however, are mostly profitable for actors betting on these futures from a safe distance. Predominant media representations operationalize the rhetoric of existential urgency to enable new forms of disaster capitalism.³ Following the historic Jakarta floods in 2007 that inundated up to seventy percent of city, the Indonesian government extended a Memorandum of Understanding on water issues with the Dutch government, asking for additional "urgency assistance" to address flood risk mitigation. Together with Dutch businesses and consultants, the Dutch government designed the National Capital Integrated Coastal Development (NCICD) Master Plan; a US\$40 billion infrastructural megaproject involving the construction of an outer sea wall and offshore real estate development that "offers many possibilities to create added value for the city and funding through land reclamations."⁴ Although the plan acknowledges that the most cost effective strategy for flood risk mitigation in Jakarta is to reduce land subsidence—even stating that it would make the forty-billion-dollar NCICD project "unnecessary altogether"—the plan itself does not address this issue,

and instead insists that the colossal infrastructure of oceanic defense is necessary because the sinking of Jakarta cannot be stopped “in time.”⁵ Urgency, here, is invoked to posit a high-investment offshore masterplan as a stand-alone option, one that guarantees enormous profits for the Dutch water sector. While the NCICD project continues apace, increasing subsidence and flooding has prompted another monumental announcement by the government in 2019 for a simultaneous plan to move the capital city itself. The US\$33 billion relocation plan relies on foreign investment and major international loans and has former British prime minister Tony Blair as its asset manager.

Climate change speculation prepares the ground for market-based environmental conservation programs, financial instruments designed to manage the risks of increasingly torrential weather patterns, and ostentatious development projects that inevitably claim to save the city. All of these, in turn, create new possibilities for capital accumulation. Designers are often tasked with and engage in future-oriented modes of representation. The ways by which future projections facilitate the movement of material and exchange of credit—so often designed to enable accumulation elsewhere—call into question who is eligible to imagine, measure, or price the future, and by what means such positions of power are acquired and maintained. Operating from the future subjunctive to impact on and govern the present, monumental plans for pre-emption harness risk through an impulse to accumulate profit and power for a select few. Insisting on the urgency and singularity of the present moment is a way to assert asymmetrical claims over the control of various other possibilities while erasing the entanglements of deep, pluriversal histories and their relationships to the present. Under the pretext of a climate emergency, all possible futures are foreclosed but one: a perpetual, technosolutionist, capitalist modernity.

As designed imaginaries of the future are increasingly operationalized to facilitate new modes of extraction and governance, we must also insist that the future arrives at different times for different socioeconomic groups, as well as for different species. Urgency, speculation, and risk all play out differently at the scale of the urban masterplan than they do among the mesoscales of plural, embodied lifeworlds. Amidst various speculations regarding risk and reward, in the Anthropocene city, timescales collapse as actors with highly differentiated destinies—both near and distant—carve out niches of operation in attempts to navigate the uncertainties of climate and species continuity. The range of sensibilities and expectations that these emergent and improvisational practices produce offer important lessons for reimagining the future otherwise.

The Speculative Real Estate of Annihilation

The NCICD, a joint 2014 project undertaken by the governments of Indonesia and the Netherlands, proposes to address Jakarta's challenges of land subsidence by reinforcing the city's existing coastal seawall and constructing a new, forty-kilometer-long, twenty-five-meter-high outer sea wall for additional protection against oceanic and tidal forces. At an estimated cost of US\$40 billion, the unprecedented expense of this climate infrastructure project will be (partially) recovered through real estate investment on the seventeen reclaimed islands that compliment and extend the arc of the seawall. These islands will be formed so as to create an image of Indonesian's national symbol: a mythical eagle known as the *Garuda Raksasa* (Great Garuda).

While not originally part of the flood defense plan, the island reclamation project—which was originally proposed in 1995 to transform the fishing grounds of Jakarta's northern coast into more profitable high-end, ocean-facing residential properties—gained traction with the financial strategy of the new seawall. Although the reclamation project was blocked for years by the Indonesian Ministry of Forestry and Environment—environmental impact assessments stated that reclamation would increase the risk of flooding, destroy marine ecosystems, and negatively impact the livelihoods of fishing communities—the real estate project has now been fully integrated into the design of the NCICD.⁶

The Dutch government is also funding some of the NCICD through its “Partners for Water” program: a public-private program that provides financing for initiatives addressing flood mitigation and subsidence in overseas urban deltas, with a caveat that projects also offer prospects for “trade, investments, and contracts.”⁷ In line with the Dutch Official Development Assistance policy of “from aid to trade,” Dutch consultants involved in the development of the NCICD plan have also been contracted in the construction of reclaimed islands and dredging activities in the Jakarta Bay, alongside other Dutch companies.⁸

By exploiting atmospheric and oceanic indeterminacies, climate change as imminent threat allows developers, consultants, and politicians to reorganize the future as a means to concentrate power and capital flows in the present.⁹ At the outset of the NCICD project, Dutch consultants claimed that the city only had two years left to act if it wanted to save its northern districts. This engineered scarcity of time helped paralyze space for thinking otherwise and expedited the conditions necessary for hurried credit swaps, the purchase of concrete (especially from elite oligarchs), and foreign direct investment that reinscribes (neo)colonial power relations. Foreclosing on alternatives, consultants adamantly presented

the Great Garuda as the *only* hope for the sinking city. Jan Jaap Brinkman, a hydrologist with the Dutch consulting firm Deltares, insists: “There are only two options, retreat or advance. We either abandon and evacuate north Jakarta, which is a non-starter, or we advance out into the bay with the seawall.”¹⁰

The normalization of urgency in relation to the climate emergency is by now a common trope, especially within the context of contemporary political regimes determined to increase or extend the dimensions of sociospatial control. In order to fully titillate investors with a speculative and deferential urbanism, however, spectacular renderings are necessary. That is, to expand its frontiers of accumulation, capitalism continually produces compelling visions of a future that offers more than mere survival, or even collective flourishing: it creates and sells images of private, conspicuous, and commodious luxury. Architecture, here, becomes an affluence-branding exercise in the service of energetic squandering: flyovers noodle through a whitewashed waterfront lined with pristine (white) beaches; white towers gleam with an aura of sterility; green promenades are interlaced with solar panels and white wind turbines; and so on. All of these figures of liberated privilege deliver a vague promise to “save the city” by constructing a “new,” “world-class” identity. But for whom? Marketed with particular attention to overseas Chinese buyers, television advertising in Mandarin offers a “new vision” of a “new lifestyle”—erasing and thereby replacing the perceived chaos of Jakarta. Speculative urbanism always profits from a distance.

Even among so many promises of glassy-towered futures, urban theater seldom plays out according to the script. NCICD quickly became mired in lawsuits and controversies related to money laundering and forged environmental assessments. As gubernatorial and presidential candidates continue to adopt the controversial project in political campaigns, official narrations of the project recount its iterative interruptions and resumptions, in line with differential promises to either enable or revoke development.¹¹ Our own field work reveals that construction continues, although sometimes openly and sometimes behind securitized perimeters. Despite delays and the uncertainty of the project’s completion, its commencement has already significantly transformed the interface of the city and the sea.

But politics isn’t the only obstacle facing the seawall. On December 19, 2019, the force of the Java Sea itself obliterated a recently completed 170-meter section of the new defensive barrier. Initially guaranteed to protect the city from oceanic forces for a minimum of eighty years, this massive failure occurred only four years after construction on the new seawall began and with less than one percent of the total project completed. The collapse was blamed on

inaccurate assumptions of the maximum force load that had been factored into early engineering calculations. Concerns over the ability to accurately predict the ocean's force were hastily silenced by ministerial statements assuring residents that construction would resume. A second wall is now under construction, with additional bids, contracts, and material purchase orders. Construction continues under the pretense of preventing a future disaster, again. While fishing communities living adjacent to the construction site express concern for the potential of compounded disasters that the massive infrastructure introduces, no additional protocols have been set in place to adjudicate control measures.¹² After all, the production of failure is another autocatalysis for disaster capitalism.¹³

Capital and Chaos

In 2019, Indonesian President Joko Widodo (Jokowi) announced that in order to address monsoon flooding, land subsidence, and extreme congestion in the sprawling megacity, Indonesia would move its capital city from Jakarta to a yet-to-be-determined location in the largely rural province of East Kalimantan on the island of Borneo. In the following months, a barrage of promotional campaign events, press tours, presidential site visits, and selective and highly stylized impact studies led up to the unveiling of the chosen site and its masterplan. Rousing excitement to participate in a vision for the nation's future, the government announced an open international architecture competition to design the new city, with a particular appeal to "every Indonesian designer to participate."¹⁴ The winning competition entry, by the Indonesian-based architecture practice URBAN+, depicts a forest futurism wherein the new urban center is crossed by undisturbed, organic waterways and surrounded by a lush tropical landscape. Aggressively marketed as a "smart forest city," the new capital city promises to become "a new symbol of national identity" heralding the qualities of "smartness, beauty, and sustainability."¹⁵

Although the *Nagara Rimba Nusa* (Forest Archipelago City) campaign uses nationalist rhetoric to garner public enthusiasm at a massive scale, only a much smaller number of actors will ultimately be eligible to participate in its future. The new capital is currently designed to house 900,000 to 1.5 million people, or less than thirty percent of Jakarta's current population. Such figures are a poignant reminder that the future is not being designed to host everyone; "saving humanity" still follows deep cartographies of political economic power.

With a scheduled move-in date of 2024 (the last year of the current president's second term in office), the government

announced its plans to fast-track construction at a soft ground-breaking ceremony in July 2020. During a field visit in early March 2020, however, it was already clear that plans were well behind schedule (this was before Covid-19 had caused further impediments to work on the ground). As with the Great Garuda, an atmosphere of uncertainty envelops the project. And, despite their totalizing visions, no masterplan can escape the variegated temporalities of the biosphere: just as construction on the Great Garuda was interrupted (in fact, destroyed) by monsoon rains, the Forest Archipelago City has stalled due to complications with land acquisition, and more recently, Covid-19. As public demands are made that state funds be redirected toward more immediate and deadly threats, conflicting ministerial statements on the future of the project continue to incite gossip, grift, and speculation.¹⁶

Aside from these delays, the monumental new capital plan has elicited a range of reactions amongst residents of Indonesia, ranging from apathy and disbelief to despondency and excitement. And even if its eventual realization remains ambiguous (or unlikely), the imaginative element of the project—its conceptual vision of and for an emancipatory future—functions as the basis for contract negotiations to redistribute, rezone, and ecologically transform land. Massive land clearance and infrastructure construction is already underway.

Although currently operating under the pretense of climate adaption, these projects cannot be considered separately from the fractured histories of commodification and political ambition that they enfold. The construction currently underway builds on a long history of development projects that have penetrated the island since the 1970s, each of which has been led by ambitions to facilitate smoother access to Kalimantan's abundant fuel and forest reserves that feed the accumulation of capital elsewhere. Within the boundaries of the designated site, there are currently 162 active concessions (including for mining, forestry, palm oil plantations, and coal), ninety-four abandoned coal mining pits, and seventy-two indigenous villages, all entangled in a long history of struggle and violence to control the commodification of the Kalimantan rainforest. From global supply chains demanding the cheap accrument of palm oil, timber, and coal, to the centripetal force of capitalist firms accumulating profits in the metropole (by displacing risk elsewhere), a history of colonial and global arrangements of extraction and wealth creation are deeply imbricated within the terrain.

Evidence of this entanglement, one of President Jokowi's first decrees during his first term in office in 2014 was the immediate completion of the Trans-Kalimantan Highway project. An extensive highway circuit that cuts through the forested island to link its centers of production and sites of extraction, the Trans-Kalimantan was

one of many infrastructural projects initiated in the 1970s under the New Order Regime, a political party whose legitimacy was tied to its promise of rapid economic growth. The project opened the forest and paved the way for poachers, miners, loggers, and plantations, all while laying the foundation for a prolonged struggle against environmental and social injustice.

Since it began, the Trans-Kalimantan has been caught in start-and-stop cycles, with bursts of construction followed by sudden, indeterminate stalls due to funding challenges and poor execution. The prioritization of the capital relocation project, however, enabled legislative revisions, bill enactment, capital injection, and the immediate reallocation of the national budget to expedite the promise of the highway's completion under the president's final term in office. One of the final segments of the Trans-Kalimantan circuit is the Balikpapan-Samarinda Toll Road, where the new capital city is strategically located.

Frontiers of Contingency

If the Trans-Kalimantan Highway operates explicitly to increase the “speed and efficiency of goods, people and logistics” and “encourage the development of production areas for palm oil, coal, oil and gas and agricultural commodities,” other initiatives simultaneously parcel out the forest through a different set of instruments focused on sustainability, security, and conservation.¹⁷ In May 2020, in response to an anticipated food shortage due to the disruption of supply chains triggered by the Covid-19 pandemic, the Indonesian government announced plans for a food estate project that would convert 2.2 million acres of peatland swamps in Kalimantan into rice paddies.¹⁸

This expanded food plan should be seen alongside reports about the rapacious demand for additional land acquisition permits around the new capital. While the government promised (though has yet to enforce) a freeze of land prices in the area to avoid uncontrolled real estate speculation, there is no legislation to prevent land speculation in areas immediately adjacent to the new capital—which can now be acquired, we are told—to prevent an imminent famine. And having been traded and swapped among various international and national initiatives under frameworks of restoration, conservation, and development since the 1970s, the area zoned for the food estate project also enfold a long history of violent land control. These include the state-led Mega Rice Project, the Central Kalimantan Peatland Project (a joint project between the Dutch government, Shell, Borneo Orangutan Survival, Wetlands International, CARE, and WWF), and REDD+ (an agreement

between the governments of the Netherlands and Indonesia). While none of these projects have been carried to completion, their performative commencement has all been significant. Just as with the Great Garuda and the capital relocation, proposals for a restorative future play a key role in instigating the legislative revisions necessary to redistribute land rights and generate new patterns of ownerships, control, and displacement, regardless of whether plans are carried to completion or not.

For Indigenous communities, narratives of imminent risk perpetuate centuries of colonial violence and genocide.¹⁹ The announcement of the new capital—a project depending almost entirely on the state’s acquisition of privately owned land—led to a change to Indonesia’s property laws that made it more difficult, and sometimes illegal, to contest land conflicts.²⁰ The legislative revision also outlined investment exemptions for state-led projects, fast-tracking new resource extraction schemes. The government even suggested another legislative maneuver relying on a state of exception: a compensation scheme for land holders within the extended site of the new capital.²¹

Residential Relays

When seemingly random and unorganized acts of self-defense erupt against the violence of the state and capital, the only important question is how to maintain their connection to the social field they are meant to defend.

—Fred Moten²²

It will be increasingly difficult to see what urban residents have in common except for the increasing precarity of their existence. This is a precarity that both holds doom and enormous potential.

—AbdouMalik Simone²³

It is one thing to plan for climate change from a distance while accumulating capital elsewhere. It is quite another to live among the vicissitudes of a future that has always already arrived too soon. Even in the shadow of abandonment, the majority of Jakarta’s residents continue to rearrange and reposition themselves, creating new alternatives to reinvent viable livelihoods.

I first met Abdul Kodir, an environmental activist and cofounder of the Ciliwung Institute, in 2017. As we sat along the upstream banks of the Ciliwung River—one of the thirteen rivers that flow through Jakarta—he described the transformations of the Ciliwung watershed that he had witnessed over the course of his

life on and alongside the river. The significance of urban boundaries grew increasingly apparent during our conversation, especially as he described how policies that attended to the river were usually only focused on the segments of the river that crossed through the city. Meanwhile, the river flows through three cities, with Jakarta at its most downstream jurisdiction, before it empties into the Java Sea. The continued insistence that the river should be modulated by the spatiotemporalities of politics rather than geophysics—that seasonal flooding must not disrupt the economic activities within the administrative boundaries of the capital during the monsoon season—has perpetuated a series of flood prevention projects confined by the boundaries of the capital district.

The overflow of water (flooding) has always characterized the behavior of the Ciliwung river.²⁴ When these inherent qualities of the river—helping to channel water from higher points in the watershed toward lower points where it can rejoin the sea—work against the regimented structures of control that characterize capitalist economies, however, they can be reframed by planners and experts as problems that must be solved. Funded by the World Bank and the Japan International Cooperation Agency (JICA), the 2013 Ciliwung River “normalization” scheme, which aims to increase the drainage capacity of the river by widening it to twice its natural width and replacing its banks with contiguous concretized edges, does exactly this. The profit-driven desire to normalize unruly natural systems leads to an ideational monoculture that forecloses on diverse, rhythmic ways of living with the river by minimizing the possibility space of socioecological relations to modes of containment, control, and separation.

On the ground, these master’s plans encounter other realities where they are often further entangled in unforeseen constellations of resistance. In terms of (construction) feasibility, the process of concretizing the riverbank has not followed the topology of the water body, but proceeds based on ease of access to the river, determined by its heterogeneous edge conditions. The completion of the project remains uncertain, as construction was halted in October 2019 (shortly after the announcement of the new capital city) due to budget cuts by the Jakarta administration. The river’s edge is now a discontinuous pastiche of partially drilled concrete piles and one-sided channelized segments scattered sporadically amongst zones of fully channelized embankments. The project’s progress so far, however, has had adverse effect. Instead of realizing the project’s aim of managing the flow of water, the concrete banks have led to an acceleration of water through the discontinuous, channelized segments of the river, thereby increasing erratic flood patterns. Any prior understanding of the river’s behavior based on its topology—its tendency to flow according to particular patterns based on observable upstream and

downstream conditions—has been completely disrupted.

As a result, the project has compromised the ability of those residents most directly affected by flooding to anticipate its arrival based on their traditional, local knowledge. The approach to risk by residents living along the river is decidedly different from that touted by consultants and politicians. Without the option of infrastructural or climatological distancing, the volatilities of risk are not perceived as a singular monumental event in the future to be preemptively designed against. Rather, by attempting to make everyday life possible within the current systems of inequality, residents adopt microspeculative practices to reposition, rearrange, and adapt to heterogeneous and accumulating forms of risk. Concrete piles and continuous dredging become just another layer among the socio-material-ecological assemblages of the river. Despite frustrations and anger, there is a refusal to live in fear and a rejection of escape: “We do what we can with what we have.”²⁵

To adjust to increasingly erratic flows of water, for instance, riverside communities quickly developed a collective, empirically indexed flood warning system, by repeatedly sharing and updating river conditions through an informal SMS network. Not limited by the boundaries of the capital, the information sharing network extended along the entire length of the river, connecting residents in Jakarta to the upstream cities of Bogor and Depok. While flooding cannot be predicted, and certainly cannot be eliminated, this empirical information sharing network has enabled residents to respond to surreptitious flooding with far more agility and creativity than without.

In reality, there are more than two bad responses to climate change—namely, concretize the coast and the river’s edge, or relocate the city to another island. For what if residents want to live with, or alongside, the tropical monsoon? As monolithic infrastructures burst under the increasing pressure of intensifying monsoon precipitation, there is much to learn from the multiplicities of adaptable, situated knowledges that suggest various ways of co-inhabiting with environments in flux. The acceptance of uncertainty, rather than a desire for control, leads to far more flexible and adaptive practices of climate adaptation.

Resident SMS networks relay observations, remain attentive to their material entanglements, and suggest different ways to think about stasis and movement in time and space. Drawing from the patterns of thought and action that derive from living *with* the rhythmic turbulences of water, our team in Indonesia began to experiment with the possibilities of extending these improvisational forms of urban coordination to the scale of the city, the region, and eventually all of Indonesia. Since 2013, we have been working on the design and implementation of an open-source platform

that transforms instant messaging and social media networks into life-saving emergency communication and coordination networks.²⁶ Harnessing the addiction of social media, and the abundant ways by which residents across the city humorously express their repeated encounters with water during the monsoon season, we have redesigned social media networks through a parasitic open source software that transforms tweets, posts, and messages into structured crowdsourced disaster reports.

As a real-time information sharing system, the platform is now used by millions of residents, first responders, and government agencies to make time-critical decisions in the face of unpredictable weather events. Rather than reinforcing illusory fantasies of control, we adopt a set of representational choices that frame the presence of water otherwise. The seasonal flood selfie has become characteristic among Jakartans. Our #SelfiesSaveLives campaign encourages residents to share these images, which act as bodily metrics of the flood water, and submit flood reports in order to alert each other and response agencies on the rapidly fluctuating conditions of the flood. Through a real-time distributed sensing network, crowd-sourced reports indicating the severity of the flood have significantly improved response times and helped mitigate risk. By supporting practices of mutual aid, with a sense of conviviality, rather than insisting on apocalyptic doom, risk can also be the pretense to amplify care and create space for the plurality of lifeworlds that are brought into closer contact as flood waters inundate the city. Living *within* the vicissitudes of the Anthropocene necessitates moving away from the addictive tendencies of apocalypse escapism and instead moving towards rehearsing practices of endurance without future certainty.

Enduring Ruins

Endurance depends on the continuous efforts of people to discover and reach each other. It is the willingness to suspend the familiar and even the counted-on in order to engage something unexpected. This engagement may sometimes be simply the reiteration of a commitment to what already is, a decision that is better to stay put with what is familiar.

At other times, it involves an effort to find a way to make what is discovered useful, to incorporate it into one's life or see it as another vehicle to be occupied; it entails the transfer of time and energy from one way of being in the world into another.
—AbdouMaliq Simone²⁷

This means telling histories of the cultural and biological synergies through which diversity continues to emerge, even in ruins.

—Anna Tsing²⁸

Along the coast of Jakarta, where sand mined from Indonesia's "outer" islands is being reclaimed to construct the seventeen new islands that form the Great Garuda, residents living in dense villages build their own infrastructures of endurance as they face immediate and frequent risks of inundation. Pointing to high water marks on their homes—each one carrying the memory of a specific flood event and the familial interactions amplified and entangled with the flow of water—residents tell their stories and explain how they incrementally raise their homes brick by brick. A conviviality is relayed during recollections about communal practices, when residents coordinate and work together to reuse resources and materials left undamaged by flooding. These narratives are often fragmentary, but they nevertheless provide critical insights into the ways atmospheric turbulence and climate speculation are forcing residents into new and often unpredictable constellations for collective action.

The divergent processes of capital accumulation and communal adaptability occurring along the coast do not occur in separate worlds. Instead, they feed on and transform one another. Residents living immediately adjacent to the construction site of the Great Garuda—having to creatively reposition themselves amongst neoliberal planning projects according to the means they have available—also enter into less traceable negotiations with construction workers and unofficial regulators to garner the materials necessary to endure in their everyday lives. At every point along the chain through a multiplicity of incremental maneuvers that slip through bureaucratic cracks, actors carve out niches of operation to navigate the uncertainties of climate futures. While variable exposures to risk rooted in historically grounded power asymmetries constrain the range of opportunities available for different groups, the heterogeneous collisions of semiotic-material entanglements reveals a possibility space for unexpected emergent forms of urban sociality. People may work together without having common aspirations, even when collaboration may not benefit all parties.

Other forces wax and wane in turn. On World Ocean Day 2020, the force of the sea burst a coastal barrier wall at a point that inundated an elite oceanview neighborhood. As private yachts and mansions were claimed by the sea, residents temporarily relocated to hotels in the city center. Living adjacent to the gated complex, less affluent communities who experience flooding far more regularly had already moved their belongings to upper floors of their

raised homes in anticipation of the high tide. The unequal distribution of risk also means that some people are more accustomed to paying attention to environmental indicators that can suddenly destroy their livelihoods. Despite the structural violence imbricated in this asymmetry, residents forge new ways to extract what is possible from this differential. Before official agencies could evacuate the mansions, village residents had repurposed carts, built out platforms, and salvaged inflatable boats to provide their own improvised evacuation service for their wealthy neighbors. The pluralities of urban lifeworlds are not always agreeable, nor are they equal, but they offer the opportunity to care for one another and fortify modes of endurance in an uncertain world.

While it is necessary to creatively engage in the immediate torrentialities of the climate crisis as they play out in our everyday lived realities, it is also critical to simultaneously allow for other possibility spaces that open out onto more generous, reconstructed futures. How we conceive possible futures matters; these concepts inflect the ways we position ourselves and engage with the full spectrum of the biosphere and its many diverse entities. To think the future otherwise is not to start from a neutral present, but to emerge from and create within the multiplicity of already occurring practices. The question becomes: How to creatively reorganize relationships and move towards the worlds we want, while salvaging what we can from the worlds we are in?

While risk models have been aggressively adopted to accelerate neoliberal capitalism, the ways they engage with future worlds also offer the chance for political inversions. In their capacity to render time-complexes that can produce recursive truths—that is, situations produced through a speculative narrative in a way that the future is always inflecting the trajectory of the present—the risk model retains a potency to overcome the limitation of the colonial, linear ordering of time.²⁹ An inversion of the model could rotate its posture from a prescriptive designation to an opening to search for radically different but latent worlds. How can we engage with a time-complex not driven by profits or electoral cycles? How can we appreciate and attend to ongoingness, history, and uncommon trajectories within environmental and political crises? By accounting for (neo)colonial and racialized capitalism, how can we simultaneously reach out to deeper radical traditions and attend to more-than-human worlds? Thinking through and with a thick, collective time—one that includes monsoon rhythms, colonial (not yet) pasts, and heterogenous imaginations of and for many futures—how can the risk model be inverted as an engine of ethical transformation by design?

The future becomes foreclosed only if we continue to succumb to the repression of alternatives by totalizing and cancelling

narratives. Especially if we care to move towards cohabitable species futures (and certainly if we are concerned with the continuation of our own species), we cannot afford a failure (or erasure) of imagination. Apocalyptic narratives are an escape from contemplating how life goes on even through torrentialities, all while erasing the concern of other lives by imagining they are already gone. A sober reckoning with the environmental, social, and political challenges of our world calls for a shift away from the temptation of escapism and a move towards finding ways to make space for pluriversal futures keyed to different traditions and their respective and changing ecologies. Only if we can imagine different futures—ones that emerge from embracing, instead of cancelling, pluralistic histories and temporalities capable of inhabiting turbulence—can we begin to work towards more viable lifeworlds.

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- 3 Naomi Klein, *The Shock Doctrine: The Rise of Disaster Capitalism* (Toronto: Knopf Canada, 2007).
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- 5 *Ibid.*, 37.
- 6 Even the logo developed for the NCICD depicts the significance of real estate in the project, focusing on a new skyline of high-rise buildings without any reference to flood adaptation
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- 14 N. Adri, "Wanted: Designs for Indonesia's new smart, green capital city," *The Jakarta Post*, October 3, 2019.
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- 17 Marchio Irfan Gorbiano, "Jokowi welcomes Kalimantan's first toll road, seeks link to new capital," *The Jakarta Post*, December 18, 2019).
- 18 On the importance of peatland ecologies for slowing climate change, see Peta Bencana, "Peat Fires & Palm Oil: An Introduction by PetaBencana.id," YouTube, November 19, 2017.
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- 24 Jakarta was built on swampland, so seasonal flooding has always been part of daily life. Early twentieth-century literary and popular representations depict the flood not as a threat, but as a festive event. For more on the shifting framing of flooding, see "Urban temporalities—Jakarta after the new order: Abidin Kusno in conversation with Meredith Miller and Etienne Turpin," *Scapegoat: Architecture, Landscape, Political Economy* 5 (September 2013): 180–205. For more on the history of flooding in Jakarta, see Frank Sedlar, "Inundated infrastructure: Jakarta's failing hydraulic infrastructure," *Michigan Journal of Sustainability* 4, (Summer 2016).
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Energy Accumulation

Gökçe Günel

“If you’re in trouble, you don’t think straight,” said Ibrahim, an electrical engineer with the Electricity Company of Ghana (ECG) while describing Ghana’s recent electricity crises. In a meeting room on the fifth floor of the Electro Volta House building, our windows looked out on Accra’s Black Star Square, a modernist public square built by the country’s first president and Pan-African statesman Kwame Nkrumah in 1961 in celebration of Ghana’s independence from colonial rule. On the wall dangled a monthly calendar that featured newly completed electrical substations across the country. Like many of the other employees I met there in late 2019, Ibrahim wore a button-down shirt featuring the ECG logo, tailored for him with fabric printed in recognition of the company’s fiftieth anniversary.

Until the year 1997, state-owned hydroelectric power plants produced all of Ghana’s electricity.¹ In the words of historian Stephan Miescher, the opening of Ghana’s Akosombo Dam in 1966 and the creation of Lake Volta—the world’s largest human-made lake by surface area and the fourth largest reservoir by volume—“produced different temporalities of an industrialized future that would transform the country’s rural past and create new cities, factories, and infrastructures.”² In the inauguration ceremony, Kwame Nkrumah announced: “It is in this spirit of fruitful collaboration for a better world for all that I ... inaugurate the Volta River Project. Let us dedicate it to Africa’s progress and prosperity. Only in this way will Africa play its full part in the achievement of world peace and for the advancement of the happiness of mankind.”³

Inadequate rainfall and rising temperatures associated with climate change, however, have negatively impacted the hydroelectric power station at Lake Volta, at times completely incapacitating it.⁴ As a result, new power producers have entered the Ghanaian electricity market since the early 2000s, mostly thermal power stations that rely on natural gas, stockpile light crude oil, and burn heavy fuel oil. Unlike Nkrumah introducing the Akosombo Dam, these power producers have not offered teleological narratives about progress, but rather quick, stopgap solutions.

From 2012 until 2015, an electricity crisis resulted in unprecedented levels of load shedding throughout Ghana. Power for industries and homes was out for twenty-four hours at a time, and turned back on for only twelve-hour periods. *Dumsor*, the name given to the crisis that means “off and on” in Twi, was brought about by low water levels in hydroelectric dams due to climate change, disruptions to natural gas flows from Nigeria, and alleged mismanagement of the grid infrastructure. In response, Ghanaian decision-makers such as Ibrahim saw a further expansion and diversification of the country’s energy portfolio as a possible solution to the crisis, shifting the nation’s energy production portfolio further away from hydropower and towards fossil fuels.

In seeking to resolve *dumsor*, the Electricity Company of Ghana, the sole electricity distributor servicing the south of Ghana, signed forty-three power purchase agreements with different vendors.⁵ As a result, new independent power producers from countries such as Turkey, China, and the United Arab Emirates set up powerplants in Ghana, using heavy fuel oil and natural gas. “Prices were so high during the emergency,” Ibrahim explained. “And many of the contracts we signed stated that we would pay whatever we agreed, which was double or more what we would usually pay, for the next decade.”

Fossil fuel-powered thermal plants today produce about two thirds of Ghana’s total electricity production. “We over-solved the problem,” a former junior member of the Energy Commission, a regulator body responsible for electricity licensing, reflected about the crisis. Between 2015 and 2020, Ghana’s electricity supply went from 2,800 megawatts—which was sized to the demand placed on the grid—to 5,000 megawatts. The new powerplants triggered an excess of electricity on the country’s grid. What has taken place in Ghana since the turn of the twenty-first century and accelerated as a result of the final episode of *dumsor* is therefore best understood not as an energy transition, but an energy accumulation.

Humans have consistently added new energy sources to the civilizational mix.⁶ The use of certain fuels is sometimes reduced as they prove undesirable or inefficient. But in contrast to what is suggested by conventional narratives about “energy transition” today, rarely are they completely abandoned or replaced. Recognizing the linearity of this dominant narrative, an energy specialist I met at the University of Ghana, Paul, remarked “maybe we are transitioning in reverse.” And indeed, many of the natural gas and heavy fuel oil powered generating plants in Ghana were previously used in countries like China and Turkey, then uprooted, broken down to pieces, and carried in cargo ships to now serve the Ghanaian grid.

Many independent power producers entered the Ghanaian market on “take-or-pay” contracts, where the Electricity Company of Ghana either bought electricity from a producer or paid the producer a penalty for electricity it did not use. “A hungry man does not need a table full of rice,” Joseph from GridCo described during an interview in his Tema office in December 2019. “Why build 5,000 megawatts when you can’t consume it?” 2,300 megawatts of Ghana’s electrical energy are produced on a take-or-pay basis. While some wondered why the Ghanaian government couldn’t use this excess for productive projects, such as rural electrification, the government has paid over \$500 million per year for electricity it did not consume.

In 2017, a news report revealed that the contract with the Emirati thermal power station AMERI had been overpriced by \$150 million, and eventually led to the removal of the Energy Minister

Boakye Agyarko from his position.⁷ Another corruption scandal broke out in April 2020, when the US Securities and Exchange Commission claimed that “Asante Berko, a former executive of a foreign-based subsidiary of a US bank holding company, arranged for his firm’s client, a Turkish energy company, to funnel at least \$2.5 million to a Ghana-based intermediary to pay illicit bribes to Ghanaian government officials in order to gain their approval of an electrical power plant project.”⁸

Given the context of mistrust and corruption, decision-makers in the country have been calling for a renegotiation of these contractual terms.⁹ In the meantime, new energy sources and relations continue to be developed. Of the 5,000 megawatt electricity production capacity on the grid, only forty megawatts currently come from solar, produced by Chinese companies in Winneba. An additional 100 megawatts are currently under construction in Bui. A second strand of solar electricity generation has taken place through rooftop solar panels, which have emerged as viable options for individuals and institutions with access to upfront capital. Many industrial facilities have also built rooftop solar panels, cutting their reliance on the Electricity Company of Ghana by half.

As a consequence of losing more of its steady and paying clients to rooftop solar panels, and being trapped in take-or-pay contracts with independent power producers, the Electricity Company of Ghana had been forced to increase tariffs. “Imagine industrial facilities as the business class passengers on a plane,” remarked Belinda, a young energy professional with the Energy Commission. “They subsidize flights for economy class passengers, and in turn receive special treatment, say, they’re offered champagne. Industrial consumers in Ghana subsidize residential consumers, and complain that they are not receiving any special treatment. We give them no champagne, so they slowly reduce their reliance on the grid.”

In this context, some hope new business models will come to the rescue. “Have you seen the solar map of Ghana?” Raymond, a legal advisor to GridCo, asked me enthusiastically. “We are missing opportunities by not building solar here.” He celebrated the green financing programs that some Ghanaian banks had recently started, offering funding for domestic and institutional consumers bidding to build rooftop solar panels. “Once you prove that your project is lowering emissions, your interest rates fall. There are incentives for building solar,” representatives at Ghana’s Cal Bank confirmed. Dressed in polo shirts advertising their green financing programs, four Cal Bank men told me that they offer three-to-five-year loans for rooftop solar projects, but have had trouble attracting individuals with stable jobs for these loans.

The future does not hold the promise of stable flows of electricity on the grid for energy professionals in Ghana. Instead, energy

professionals anticipate power outages. Joseph, a senior electrical engineer with GridCo, told me that he lived very close to the headquarters of the grid company in Tema because he wanted to arrive at the control room as quickly as possible when a blackout occurred. A devoted member of one of the most popular and charismatic churches in West Africa, he summarized his relationship to *dumsor* by using an analogy: “Can you kill the devil? The world would be a very beautiful place if you could kill the devil. But you can’t kill it. You have to stay away from its control.” According to Joseph, reduced flows and increasing costs of electricity will continue to characterize the Ghanaian grid for the years to come. Regardless of their countless complications, Joseph hoped that energy accumulation would temporarily manage to keep the devil away.

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- 6 Jennifer Wenzel, “Forms of Life: Thinking Fossil Infrastructure and its Narrative Grammar,” (unpublished manuscript, n. d.).
- 7 Synnøve Åsebø, Rolf J. Wilderøe, and Amund Bakke Foss, “Exposed: John Mahama brings Ameri Group to Namibia,” *VG*, November 13, 2017.
- 8 For more information on the case, see U.S. Securities and Exchange Commission, “SEC charges Former Executive of Financial Services Company with FCPA Violations,” U.S. Securities and Exchange Commission, April 13, 2020. For Berko’s response, see “Asante Berko rejects bribery allegations by U.S. Securities and Exchange Commission,” *Joy Online*, April 14, 2020.
- 9 See for instance “Government to renegotiate ‘take-or-pay’ contracts in the energy sector,” *Ghana Business News*, July 30, 2019.

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*Metabolic Rift,
Gift, and Shift*

Kiel Moe

In the discipline of architecture, buildings are primarily characterized as objects. The composition of a building, for example, is what emphatically matters in the design studio of both academia and practice. The cultural implications of a building's objecthood are common currency in architectural journalism and history courses alike. And the assembly, performance, and efficiency of the building-object is the focus of technical courses and consultants. But from where does the accumulation of matter, energy, and information inherent to the architectural object come from? And is it really an object, or merely the hardened edge of larger, planetary relations?

Architects are habitually indifferent to such concerns about architecture's ecological, social, and political conundrums. The actual ecology of matter, energy, and information in any building-as-object is left as an externality to the discipline. But architecture is an absolutely terrestrial activity. Architects design and specify how the thin surface of the planet is re-organized—not just in terms of its focus on buildings on particular sites, but more significantly through its broader ecology of construction that produces unequal exchanges among different parts of the planet.

By externalizing the terrestrial processes that are the basis of building, in even its most putatively “sustainable” examples, architecture simply shifts environmental loads to other places. There is a constitutive rift between buildings understood as objects and buildings understood as composites of planetary processes. From where does this paucity of biogeospheric curiosity, imagination, and agency come from? Architecture neither teaches nor practices its own geographic, ecologic, and energetic contingencies. By internalizing its contingent construction ecology and processes, however, the design of more just terrestrial outcomes might finally become possible.

Metabolic Rift

In nineteenth-century England, Marx observed that rural resources were increasingly extracted and concentrated in the industrializing urban centers, without replenishment.¹ To maintain a supply of food and material resources for the town, the rural soil needed to be artificially replenished with fertilizers, since the “night soils”—byproducts of the urban centers—were not fed back to the countryside in the emergent form of city-centric urbanization. In studying these terrestrial relations, Marx drew primarily on the work of German agricultural chemist Justus von Liebig who used the term “metabolism” to describe the exchanges of consumption and feedback that characterize biological systems.² Observing the increasing divide between town and country—the “urbanization

of the countryside”—Marx identified a fundamental disruption—a “rift”—in the ecological relations of people and the material systems that support them.

The sources for British soil fertilization were global: from bones on Napoleonic battlefields to, most famously, guano imports from Peru harvested by Chinese slave labor.³ An asymmetry of accumulation characterizes this unequal exchange: a rural abundance is plundered and then concentrated in an urban core. This break in the soil’s metabolism—nutrients taken out in the form of food or textile material coupled with no refreshment of those nutrients—marked a problematically unequal exchange in this early, emblematic stage of modernization. The alienation of people and places inherent in this was only exacerbated by the geographic extent of the guano trade, as well as the food and clothing trade that begat the soil exhaustion in the first place. The rift is as once physical—the unequal exchange of resources between core and periphery—as well as cognitive—those in urban centers increasingly became unaware of the source of their metabolic throughputs.

While he did not directly use the specific phrase “metabolic rift,” Marx did observe that large-scale agricultural practices produce “conditions that provoke an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself. The result of this is a squandering of the vitality of the soil.”⁴ In Marx’s mind, the “natural laws” that govern how energy is captured and channeled in matter—soil, in this case—extended to the energy captured and channeled through human labor.

Marx articulated the extractive nature of capitalism and how it reorganizes the work of the planet—be it human or nonhuman—in novel, unequal ways. James O’Connor has argued that Marx’s thoughts on this “irreparable rift” also illuminate a “second contradiction” of capitalism and other modernization processes. Where Marx observed as a first contradiction that overproduction leads capitalism to be unable to maintain sufficient conditions for endless accumulation, O’Connor identifies that it also engenders a second contradiction of “underproduction.”⁵ In their efforts to maintain production and accumulation and “defend or restore profits by cutting or externalizing costs,” O’Connor writes: “the unintended effect is to reduce the ‘productivity’ of the conditions of production and hence to raise average costs.”⁶ In other words, O’Connor observes that when an ecological system is overexploited, it becomes less productive, thereby hampering continued exploitation, thus building on Marx’s related observations regarding human labor.

Put into current discourse, Jason W. Moore observes that this second contradiction “might take the form of soil exhaustion or deforestation, but it might also take the form of defunding

public education or the deterioration of vital infrastructures.”⁷ In other words, the metabolic rift and its contradictions are constitutive of modernization and its unevenness, leading to overdevelopment in certain parts of the world and underdevelopment in extractive zones.⁸

The soil metabolism problem that Marx observed is but an emblematic example of the far more vertiginous gap evidenced between architecture construed as a composed object and architecture understood as a composition of terrestrial processes. Focused on the object, architects generally have no cognition of—and no agenda for—the latent ecological power habitually squandered in the vast accumulations of matter, energy, and information that constitute buildings. Thus, consequential rifts emerge between what architects design and the actual terrestrial presence of what gets built. Not much better, however, are architects who employ techno-managerial tropes of efficiency and conservation in their disposition to environmental awareness in design. In these approaches, litanies of statistics are frequently used to portray architecture’s accumulated matter and fuel as excessive.⁹ However, the immense resources accumulated in architecture are not inherently problematic, whereas the tropes of efficiency and conservation are.¹⁰

Architecture only exists as a surplus to shelter. Even the most basic building requires a great accumulation of matter and energy to exist and persist, but architecture will always require more. Architecture is an instantiation of building that inherently involves more resources—be it of matter, energy, information, wealth, ambition, desire, or labor. The constitutive resources necessary for building therefore puts architecture in a nontrivial position in the metabolic economy of terrestrial material and energy systems. Architecture’s metabolic rift obfuscates the potential role of its vast accumulation of matter and energy. Architects could choose to help organize these larger energetics through design.

Georges Bataille perceived accumulation, and its squander, in terms other than efficiency and conservation. “On the surface of the globe,” he wrote, “*for living matter in general*, energy is always in excess; the question is always posed in terms of extravagance. The choice is limited to how the wealth is to be squandered.”¹¹ From Bataille’s perspective, forms of ultimately beneficial “waste” are the desired outcomes of accumulation. He notes that a living organism

receives more energy than is necessary for maintaining life; the excess energy (wealth) can be used for the growth of a system (e.g. an organism); if the system can no longer grow, or if the excess cannot be completely absorbed in its growth, it must necessarily be lost without profit; it must be spent, willingly or not, gloriously or catastrophically.¹²

Bataille's sometimes ponderous evocations such as this are nonetheless well grounded in scientific observations of the earth's solar economy. The planet earth receives around 160,000 terawatts of gross solar radiation annually, while civilization consumes only about 19 terawatts of exergy, or energy that is available to do work.¹³ The abundance of solar radiation poses radically different views on the character of any so-called energy crisis: exergy is in abundance on the planet, while hydrocarbon fuels are by definition not as much.

To grasp the mutual benefits of this excess requires a substantially broader perspective than conventional formal or energy analysis in architecture. "Changing from the perspectives of *restrictive* economy to those of a *general* economy," Bataille notes, "actually accomplishes a Copernican transformation: a reversal of thinking—and of ethics."¹⁴ Architecture's necessary excess is an asset in what Bataille refers to as a general economy, or the open system of planetary energetics. Minimizing the fuel dynamics of a building—as in the restrictive economy of current energy efficiency practices—thus denies engagement with our broader energetics. This suggests a radical shift in assumptions about the economy of energy flows, and about what is to be composed in the formation of buildings. The issue, from this perspective, is not whether squandering material or energy is good or bad. A different focus—and ethic—is at stake. The negative characterization of squander persists in the capital-driven notions of efficiency that underlie the technomanagerial tendency of much environmental praxis in architecture and related fields, and ultimately misses the potential of a general economy of energetics.

If solar superabundance is inevitable and requires some form of apparent waste, the issue, then, is how that superabundance of energy is best captured and channeled through design. Self-organizing systems, such as forests, do just this. A forest is a cascade of solar energy, comprised of often inefficient components. These inefficiencies are what allow for the development of mutualities, which is in turn what makes forests ecologically powerful—cycling ever more energy, material, and information through its system. One species' inefficient waste is another species' intake. We breathe a tree's waste, and vice versa. The immense opportunities for similar reciprocity is lost when architects construe buildings as objects. Architecture's metabolic rifts obfuscates the latent power of our planet's solar accumulation and we generally lack the means to reason and imagine how architecture might better fit into planetary energetics. As Bataille notes, "our ignorance only has this incontestable effect: It causes us to *undergo* what we could *bring about* in our own way, if we understood. It deprives us of the choice of an apparent waste that might suit us."¹⁵

Bataille's observation that "man's disregard for the material basis of his life still causes him to err in a serious way" is poignant, but runs counter to many assumptions about material and energy consumption.¹⁶ Pseudo-ecological assumptions that pervade architecture focused on efficiency and conservation might be "less bad" in terms of energetics, but they perpetuate architecture's metabolic rifts just as much as ecologically unmotivated practices. The restrictive economy perspective of operational fuel minimization through design, rather than maximizing the broader energetic and ecological potential through design, ultimately restricts the capacity of architecture to impact life on this planet in the most vital ways. Instead of perceiving the immense resources intrinsic to building as a liability, what if we were to reflect more deeply on the necessary excess of architecture, and consider building as a metabolic *gift*?

Metabolic Gift

Buildings are lodged in a hierarchical cascade of terrestrial energetics driven almost entirely by a superabundant solar input. The ecosystem scientist Howard T. Odum developed a methodology to map energy systems that, by using a unit of solar energy ("emojoules") as its metric, allows all objects and processes to be compared. Thus, an "energy" system reflects the historical record of exergy that has cascaded through the system in space and over time. The position of anything in an energy hierarchy, such as a building, is therefore an index of its "transformities," or the cascading, successive transformations of solar energy embedded within that system.

Much like Bataille's description of planetary energetics as a general economy, Odum understood energetics, in scientific terms, as open systems. Accordingly, for the large-scale energetics of a forest or building, Odum outlined what he calls the maximum power principle: "in the competition among self-organizing processes, network designs that maximize *empower*," or their power (energy) intake and their transformities, "will prevail."¹⁷ In other words, optimal systems maximize rather than minimize their capacity to do work on their milieu. To do so, energy systems do not simply maximize or minimize energetic and material intake. Rather, they select network behaviors which reinforce mutual conditions that will feed back into the system in productive ways, making it and the system more powerful overall. The results are systems of great mutuality and accumulation. This should be one primary purpose and goal of design: to help amplify the organization of our planet's open ecological systems and the planet's general economy for the good of human and nonhuman life. To do so requires situating, at long last, the energetics of architecture within planetary energetics. There is

tremendous latent design agency in the larger construction ecology of building: new practices, new activist frontlines, new business models, and new futures for architecture.

In the context of planetary energy hierarchies, the role of high transformity objects and processes (such as buildings, people, and information) is paramount. Objects and processes in an energy system of high transformity are characterized by Odum as “high quality” because of their capacity for feedback reinforcement. Odum describes feedback reinforcement in a specific way: “the action of a unit or process to enhance production and survival of a contributing unit or process, thereby enhancing itself; a loop of mutually enhancing interactions.”¹⁸

As specifiers of great amounts of matter, energy, and information, architects hold a meaningful but currently unwitting position in the energy hierarchies of building. Architectural design should thus not merely focus on an object, but on its terrestrial basis and develop mutually reinforcing terrestrial systems. Design the object and the system—the log cabin and the forest. As such, architecture’s necessary excess need not be a liability, something to be made efficient or less “bad” as technomanagerial designers and engineers would portray it. Rather, this excess in fact presents significant terrestrial potential. It is precisely architecture’s necessary excess that can afford architecture more ecological power through design. Architecture and ecological systems both thrive on surplus, abundance, and excess.

Many types of architectural analysis—energy simulations, embodied energy analysis, and Life cycle analysis—neglect important biogeophysical inputs as well as different energy hierarchies. As Ravi Srinivasan, William Braham, Daniel Campbell, and Charlie Curcija collectively note, “The notion that raw materials for building construction are plentiful and can be extracted ‘at will’ from Earth’s geobiosphere, and that these materials do not undergo any degradation or related deterioration in energy performance while in use is alarming and entirely inaccurate.”¹⁹ In this respect, architecture does not need to become more environmental or ecological. Rather, architects need to become aware of just how terrestrial, and thus ecological, architecture has always been.

Metabolic Shift

Taken together, the terms of architecture’s metabolic rift and gift demand a metabolic shift sharply in the direction of maximum power designs for the terrestrial basis of building. Rather than autarkical impulses, contemporary life needs the affordances and abundance that emerge from mutuality and reinforcement

design. The metabolic gift of architecture's necessary excess suggests that architects should be more invested in the planetary dynamics and multifarious pathways of solar accumulation than capital accumulation alone. Architecture needs a different interpretation of the sun, and thereby a different relationship with capital.

Vast resources are squandered on architecture. Architecture requires a significant accumulation of resources for its construction and operation. Yet as ecosystems theory establishes, the question is not whether architecture should accumulate or not, but rather which type of accumulation—capital or solar—architecture ultimately amplifies. Powerful natural systems freely squander in a form of ecological munificence. It is time to reinterpret the vast resources of architecture in similarly munificent terms, in more sane and just ways. This will never be possible in any description of architecture as an object. Rather it can only emerge through a re-description of what all architecture is and does as a terrestrial system, one that massively reorganizes the thin crust of this planet for ill or good. The object of architecture is no longer merely objects alone. What is ultimately at stake is the profound, consequential distinction between the design of a building and the design of building.

- 1 John Bellamy Foster, *Marx's Ecology: Materialism and Nature* (New York: Monthly Review Press, 2000).
- 2 John Bellamy Foster, "Marx's Theory of Metabolic Rift: Classical Foundations for Environmental Sociology," *American Journal of Sociology* 105, no. 2 (September 1999): 366-405; Justus von Liebig, *The Natural Laws of Husbandry* (New York: D. Appleton, 1863); Justus von Liebig, *Letters on Modern Agriculture* (London: Walton & Maberly, 1859).
- 3 Brett Clark and John Bellamy Foster, "Ecological Imperialism and the Global Metabolic Rift: Unequal Exchange and the Guano/Nitrates Trade," *International Journal of Comparative Sociology* 50, no. 3-4 (May 2009): 311-334.
- 4 Karl Marx, *Capital, vol. III* (New York: Vintage, 1981), 949-50.
- 5 James O'Connor, *Natural Causes: Essays in Ecological Marxism* (New York: The Guilford Press, 1998), 158-177.
- 6 *Ibid.*, 245.
- 7 Jason W. Moore, "Transcending the metabolic rift: a theory of crises in the capitalist world ecology," *The Journal of Peasant Studies* 38, no. 1: 12-13.
- 8 Extraction is properly understood as a type of underdevelopment. The process extracts natural wealth and sends it to an accumulation center. As a result, the extractive periphery successively loses economic wealth and ecological capacity. Stephen G. Bunker, *Underdeveloping the Amazon: Extraction, Unequal Exchange, and the Failure of the Modern State* (Champaign: University of Illinois Press, 1985).
- 9 The opening pages of several books with claims about sustainability share this rhetoric. For examples, see Brenda and Robert Vale, *Towards a Green Architecture: Six Practical Case Studies* (London: RIBA Publications Ltd., 1991); Richard L. Crowther, *Ecologic Architecture* (Boston: Butterworth Architecture, 1992); Rocky Mountain Institute, *A Primer on Sustainable Building* (Aspen, CO: Rocky Mountain Institute,

- 1995); Laura C. Zeiher, *The Ecology of Architecture: A Complete Guide to Creating the Environmentally Conscious Building* (New York: Whitney Library of Design, 1996); Klaus Daniels, *The Technology of Ecological Building: Basic Principles and Measures, Examples and Ideas*, trans. Elizabeth Schwaiger (Boston: Birkhauser Verlag, 1997); Sandra Mendler and William Odell, *The HOK Guidebook to Sustainable Design* (New York: John Wiley & Sons, Inc., 2000).
- 10 There is a nontrivial arc of consideration of exudation through the notion of accumulation and squandering in the thought of Marx, Friedrich Engels, Thorstein Veblen, Marcel Mauss, Georges Bataille, and Howard T. Odum. Each of these thinkers understands the inevitability of squander in alternate ways. Although of disparate fields, when juxtaposed, these alternate understandings of accumulation and squandering become necessary tools of thought on this topic.
 - 11 Georges Bataille, *The Accursed Share* (New York: Zone Books, 1988), 23.
 - 12 *Ibid.*, 21.
 - 13 Mark T. Brown and Sergio Ulgiati, "Updated evaluation of exergy and emergy driving the geobiosphere: A review and refinement of the emergy baseline," *Ecological Modelling*, 221, no. 20 (October 2010): 2503.
 - 14 Bataille, 25.
 - 15 Bataille, 23–4. Emphasis in the original.
 - 16 Bataille, 21.
 - 17 Howard T. Odum, *Environmental Accounting: Emergy and Environmental Decision Making* (New York: Wiley, 1996), 16.
 - 18 *Ibid.*, 289.
 - 19 Ravi S. Srinivasan, William W. Braham, Daniel E. Campbell, and Charlie D. Curcija, "Re(De)fining Net Zero Energy: Renewable Emergy Balance in environmental building design," *Building and Environment* 47 (January 2012): 301.

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At the Moraine

Amanda Boetzkes
and Jeff Diamanti



I. Moraine
(Kangerlussuaq, Greenland)

Delayed in Kangerlussuaq, Greenland, we stand at the moraine of the Greenland Ice Sheet. We are a short distance from the international airport on what used to be an American air base until it was ceded to Greenland in 1992. It is September 2018, and we are bound for Ilulissat, a township of four thousand people located 264 kilometers north of here. Ilulissat (the Greenlandic word for “iceberg”) is generally considered to be the iceberg capital of the world. However, an incoming storm has delayed our flight. We are told that delays of up to several days are commonplace here due to volatile weather conditions.

We are in West Greenland because this is where glaciologists predict global climate change dynamics through the study of the Greenland Ice Sheet (known to them as the GrIS). Calculating the variability of the surface mass balance of the GrIS is essential for anticipating the rise of global temperature and consequent positive feedback loops. But we are not glaciologists; we are compelled by Greenland’s unusual geopolitical position. While modeling glacier melt dynamics generates a global scientific perspective of climate change, the political ecology of ice must be considered with respect to the sovereign Inuit nation of which the GrIS is an integral part.¹

Today, over ninety percent of Greenlanders claim Inuit ancestry. Since the end of the Second World War, Greenlanders have undertaken a series of political breaks from the hegemony of the Danish Realm established in the eighteenth century. Greenland achieved Home Rule in 1979 and Self-Government in 2008. The history of the Arctic was shaped by the colonial drive to extract resources and claim the coasts of Greenland with European, American, and ultimately Danish settlements. Recent decades of Greenlandic sovereignty have given rise to a new social and political condition, yet one that is increasingly challenged by climate change.

Climate change has caused warming Arctic waters and the disappearance of sea ice, an effect that deeply compromises the hunting environment and social ecology of seasonal migration for Greenland’s subsistence hunters.² As Greenland seeks economic expansion to consolidate its sovereignty, the effects of climate change entrench the country further in this ecological predicament. The abundance of meltwater from the GrIS is an ideal resource for industrial mining, forcing Greenland to navigate the pressures of multinational corporations speculating for rare earth minerals such as uranium. The accelerating melt of the GrIS is therefore both an intensified symptom of a global ecological crisis unfolding on Inuit

land, and the dangerous condition of possibility for the reproduction of capitalism's system of power and profit integrating itself in the web of life.³

At the heart of this geopolitical dilemma is the question of whether Greenlandic sovereignty can only be secured by profiting from climate change, or if Greenland's self-determination and political organizations can shift the global climate change imaginary in more fundamental ways. This is not to suggest that Greenlandic sovereignty depends on the accelerated loss of the GrIS, but rather that the melting GrIS is the dynamic ground from which to imagine, resource, and build futures. Geopolitics, glaciology, and environmental imperatives do not necessarily find a common ground here, nor a unified perspective. Instead, they collide, dispersing and diffracting the pretences of such a unity.

What strikes us in Kangerlussuaq is not the glacier ice but the moraine. Moraine is the geological detritus left by glaciers as they recede. It is a material that ranges from vast boulders (called "glacier erratics") to a fine mineral-rich sand (glacial till, also known as "glacier rock flour"). Moraine is also the term for the land formation produced by this accumulation of rocky debris, which appears as a petrified riverbed. Moraines are routinely surveyed, sampled, graphed, and pictured as part of the emerging climate change imaginary. They mark the irreversible disappearance of glaciers. To us, they are the rough ground of a new planetary reality.

If, during the era of colonial discovery, the edge of a glacier could move a viewer to an experience of sublime awe, then here, in Kangerlussuaq, the moraine confronts us with the fractures, gaps, and limits of knowledge that disassemble our understanding of place. It is a site of "transit," a concept that Indigenous scholar Jodi Byrd uses to describe the force that destabilizes any singular cultural standpoint.⁴ The moraine discloses the planetary intrusions, local ecologies, and the forces of globalization that defy an objective scientific account of climate change in Greenland.

As an analytic, moraine solicits a processual form of thinking. We are not here in search of facts and information, or a dramatic environmental disaster story, but rather to elicit new ways of inhabiting, co-habiting, co-existing, and observing.⁵ To situate our inquiry at the moraine is therefore to take a philosophical *posture* on a shifting geological ground. In this respect, we turn to the (non)philosopher Francois Laruelle for whom all philosophy is material, embodied, and integrated into its situation.⁶ In this way, there is a recursion between the thinking we bring to Greenland, and its material expressions that are taken up in and through the posture by which we experience. Any posture that attempts to cope with the matter and meaning of glacier melt must span the conditions of local specificity and global commonality. What happens

in Greenland captures the imagination in North America, Europe, South America, the United Arab Emirates, and beyond. The moraine of Kangerlussuaq is not a landscape, a stable topography, or an abstraction: it is a site where forms and relations melt, where abstractions collapse under the forces of climate change, where new materials emerge and new epistemic standpoints are forged.

II. Glacier Erratic (Emmen, Netherlands)

In February 2019, we traveled to Utrecht, Netherlands to consult with Brice Noël, a glaciologist specializing in the modeling of the “ablation zones” of the GrIS. Ablation zones are low-altitude areas at the edge of a glacier where there are net losses of ice; areas where snow does not accumulate and exposed meltwater lakes and waterways course through the ice, introducing a level of unpredictability to the overall surface mass balance of the Ice Sheet.⁷

On our way back to Amsterdam, consolidating what we learned about glacier modeling that day, we were unexpectedly drawn to another form of moraine. We took a detour north to Emmen to see Robert Smithson’s *Broken Circle/Spiral Hill* (1971). The work is located in a sandpit at the Southern tip of De Hondsrug, a UNESCO Global Geopark. The fact that the sandpit was comprised of moraine from the Little Ice Age and repurposed to serve as an industrial resource was not lost on Smithson. The artist had long situated his work at the interstices of geological prehistory and a fictional, postindustrial future. He also became enamored with moraine at the peak of his career in the early 1970s. Indeed, one might say that moraine preyed on his thoughts and followed his practice.

Smithson’s original plan to clear a plateau of sand on which to set the decentered figure of a broken circle was thwarted when a boulder—a glacier erratic—situated at the very center of the plateau proved impossibly heavy to move. The boulder loomed over his plans like a “dark spot of exasperation, a geological gangrene on the sandy expanse,” a “shadowy lump,” a pending catastrophe like “the eye of a hurricane.”⁸ Troubled by the intrusive presence of this geological excess, Smithson eventually came to embrace it as an integral part of the artwork. Where his previous work sought to decenter art from a fixed point in time and space and resituate it in fragments across sites and nonsites, the glacier erratic here introduced a hard core of geological time, a metonymic element of the Ice Age that troubled the visual field like a glacial “heart of darkness.” Indeed, it appears to engulf the edges of the work from its very center.⁹ In the script for a film of *Broken Circle*, he writes:

The Ice Age advancing—receding on the edge of the moraine off the record—no time passing—no knowledge of the glacial bulldozing—no knowledge of machnical [sic] bulldozing—dozing on the moraine—dozing on the machine—grain by grain—stone by stone—rock by rock—boulder by boulder—a sluggish order—land into water—water to land—glacial memories...¹⁰

III. Glacier Rock Flour (The Dead Glacier, Ilulissat, Greenland)

In June 2019, we held a workshop about glacier melt and climate change cultures in Ilulissat. On the second day of the workshop, we brought our group by helicopter to two locations on the edge of the Greenland Ice Sheet. The first location, called “The Dead Glacier,” was an expanse of fine sand that issued from underneath a melting ice wall. The Dead Glacier has its name because of the ice wall, which has stagnated in place and no longer moves in seasonal rhythms of expansion and contraction. Nor does it calve icebergs. Instead, the glacier edge has been halted in place by a rocky bank under the fjord. Still, meltwater streams over the surface of the ice wall in the heat of the bright summer sun. The moraine here is comprised of a soft till, making it a pleasing ground to explore.

One might be inclined to frame moraine in melancholic terms as the inert material remainder of a once sublime glacial landscape. Yet moraine is not inert at all; nor is it melancholic. For many Greenlanders, moraines are sites of opportunity. The disappearance of glaciers uncovers new resources from the rich earth underneath. Moraines yield geochemical compositions such as glacier rock flour, the powdery sediment left by the crushing forces of glacier ice against rock. The Greenlandic geologist Minik Rosing has discovered that glacier rock flour is a powerful fertilizer and has studied its use to replenish crops in Brazil and sub-Saharan Africa, where desertification has impoverished the quality of agricultural land.¹¹ Rosing’s research is championed among Greenlanders and held as a model of adaptability to the epochal shifts of climate change.

Here, the land is primed to draw out vital substances and promises to enliven new global infrastructures. Yet, this place also seems to be eerily premediated by discourses of economic development, prospecting, ecological mourning, and postcoloniality. If climate change premediates the GrIS, it also anticipates the futurity of the moraine: a future weighted by colonial exploitation and the momentum of late liberalism.¹² Moraine is at the crossroads between the utopian possibilities of sovereign land, scientific innovation, and ecological plenitude, and the dystopian intensifications of climate instability. To acknowledge and think this place is also to

know that wherever we are on the planet, the moraine is *upon us*. Poised for worldwide distribution and land remediation, it is not just a geological form but a global force as well.

IV. Posture (The Blue Lake, Ilulissat, Greenland)

Locating ourselves at the moraine, the question that arose for us was, what posture might we take to re-cognize our respective forms of knowledge and experience in relation to the Greenland Ice Sheet and with respect to Greenlandic sovereignty? And how might we theorize this positioning so as to extricate it from the fraught history of colonization and resource capitalism, and imagine its future differently? Bruno Latour calls on metaphors of dramaturgy to define the expressive interactions between humans, other beings, and the earth.¹³ Through expressive action, the earth is transformed by our doing just as we are transformed by it. Resituated in this way, action has begun to change alongside agency, so that action is no longer merely a matter of causality (as a matter of the past flowing into the present), but rather becomes “the co-occurrence and interaction between agents, the outcome of which is the unfolding of the system.”¹⁴

After our visit to the Dead Glacier, we took the helicopter to a second location, the Blue Lake. At this dazzling place, the Ice Sheet extended for miles in all directions. Yet, it seemed that the ice underfoot might collapse at any moment. There, Jessie Kleemann, an artist hailing from Upernavik in northwest Greenland, began a performance titled *Arkticós Doloros (The Arctic in Pain)*.¹⁵ Dressed in a flowing vestment, Kleemann unfurled a bolt of black fabric, holding it in place at one end with a string of compact fluorescent lightbulbs. Lifting the fabric at its far edge, she turned against the wind, and let the fabric billow out behind her like a windsail. She then wound rope around her eyes and head, and blindly walked out onto the precarious surface of the ice, with arms outstretched as though in a trance-like state. Eventually, she folded up the fabric, rope and string of lightbulbs into a tangled bundle and cradled it as though it was a baby, her facial features overtaken by a wash of grief.

Kleemann’s performance work has been linked to Tuukkaq Theater, a form initiated by an Italian theater director, Eugenio Barba and developed by Greenlanders living in Denmark in the 1970s. Tuukkaq Theater allowed for a renewal of Greenlandic identity based on historical Inuit cultural practices, especially drum dancing and mask dancing. But while Tuukkaq was originally intended to affirm the beauty of Inuit culture in a globalized world, Kleemann’s performances surface the more complex feelings of

loss, shame, and inferiority, and in the case of her performance at the Blue Lake, grief.¹⁶ Her practice is rife with the ambivalence of being positioned as both “Indigenous” and a “cosmopolitan European” in addressing glacier melt.¹⁷

To address this ambivalent shifting of identity in her practice, Kleemann draws from the figure of the *qivittoq* which, in Greenlandic oral tradition, is a stranger whose strangeness is acquired at a distance from their home, wandering in the wilderness either by choice or force—an alienating and alienated persona that bears a relation to home but is not homely. As Kleemann describes it:

A *qivittoq* is a person who has left their settlement or village and the community of the family. There are many myths concerning a person’s becoming a *qivittoq* when that person has gone away, so far into his natural surroundings that he is regarded as having acquired supernatural strength and powers. In the North Greenland of my childhood the worst thing that could happen to you was to run into a *qivittoq*, be visited by a *qivittoq* or even become one.¹⁸

Upon reflection, however, Kleemann noted that her performance at the Blue Lake was not derived from the figure of *qivittoq*; something else happened at this site. “The whole place, shaking underneath my feet, was speaking a language unknown to us.”¹⁹ The figure of the *qivittoq* dissolved into what Kleemann described as “the distinct language of the ice, the dead [dying] glacier.”²⁰ Kleemann’s performance at Blue Lake knotted that place to the cultural meanings of ice in Greenland, from colonial violence and postcolonial memory, to the human and nonhuman relations that animate Greenlandic ties to the land. But it also exceeded this scaffolding of meaning.

V. Leviathan Iceberg
(Fujairah, United Arab Emirates, March 2019)

The GrIS stands at a crucial juncture. Its entangled history with the Inuit might strengthen Greenland’s geopolitical position as the global temperature rises. New materials are already being resourced from its receding edge. But its melt might be crudely imagined as a standing reserve of hydrocommodities that will be deployed to further entrench the supremacy of global oil. Perhaps one of the most extreme examples of this geoengineering imaginary is the proposal made by an Emirati consultancy firm, National Advisor Bureau Limited, to harvest icebergs from Antarctica and tow them to the United Arab Emirates. Purportedly, these “Leviathan icebergs” would precipitate their own microclimates,

breathing life back into the desert, and most importantly, providing a source of water for refining oil. According to the proposal, icebergs would be chipped off from the Antarctic Ice Sheet and tugged 12,000 kilometers by a fleet of boats up to the Gulf of Oman and the eastern coast of the United Arab Emirates to Fujairah, the most important oil terminal connecting Middle Eastern oil trade in the Persian Gulf to international markets.

In only a few decades, the city of Fujairah has become a global hub for tankers rounding the Strait of Hormuz. It expanded rapidly, first as the region's leading bunker fuel terminal in the 1980s and then again in the mid-2010s to store oil from Saudi Aramco as well as the Abu Dhabi National Oil Company.²¹ Today, Fujairah is the second largest bulk diesel terminal on earth. With a steady bottleneck of tankers lined up for refueling before entering into the Pacific en route to Southeast Asia and the US, from the standpoint of resource flows, we might think of the oil terminal in Fujairah as a quiet global capital of the twenty-first century; one that draws seemingly endless cues of oil tankers, foreign and precarious workers, and now glacier ice from the planetary poles.

The patents for the "Leviathan Icebergs" proposal were submitted to a London office in 2015 and are set to be ratified in 2020 thanks to an investment of fifty million USD from Abdullah Mohammad Sulaiman Alshehi, the managing director of National Advisor Bureau Limited.²² In addition to providing fresh drinking water to inhabitants of the arid Al Badayer desert, the twenty billion gallons of ice towed from Heard Island—external territory of Australia in the southern reaches of the Indian Ocean—promises to induce the "oasification" in Fujairah, one of the driest places on earth.²³ Alshehi's self-published manifesto, *Filling the Empty Quarter* (2015), also includes a suite of megaprojects in the service of "declaring a green Jihad on the desert" such as the planting of 100 million acacia and eucalyptus trees, "aerial reforestation" or "seed bombing," and the provisioning of water harvesting through dehumidification, solar desalination, and wind-powered water cooling.²⁴ The proposal has obvious logistical challenges: the ice, for instance, would take nearly a year to drag across the increasingly warm and turbulent waters of the Indian Ocean. But its promise to fill a gap in the supply of oil seems to be a force more powerful than any technical obstacle presented by the iceberg.

Our discovery of the Leviathan Iceberg proposal came to us quite unexpectedly in March 2019, before our workshop in Greenland. We were in Dubai under the auspices of a symposium about the aesthetics and history of oil culture in the UAE.²⁵ While there, we travelled to Fujairah to see its oil terminal, where five weeks later, four oil tankers were attacked in an act of sabotage.²⁶ Two of them were Saudi tankers, one Norwegian, and the fourth

Emirati. The event triggered a flurry of threats between the US, its Gulf allies, and Iran, which had been contesting US-imposed trade sanctions for years. Within days of the sabotage, Iran announced that it was withdrawing from the 2015 Iran nuclear agreement (the Joint Comprehensive Plan of Action), that it would refuse to export enriched uranium, and that it would once again begin enriching its own.²⁷ Between the US pressure on Iran and Iran's retaliation in the form of nuclear escalation, pressure is rising to find new suppliers of uranium, such as Greenland.

The Leviathan Iceberg presents an antithetical form of geological enframement from the moraine. Where the former fulfills the fantasy of a climate reserve that ultimately serves global oil warfare and further exacerbates climate change, the latter dispels the resourcing of Greenland toward this destructive cycle. The Leviathan Iceberg seeks to accumulate energy from the very symptoms of climate crisis, rather than letting the geological forces unsettle the global distribution of resources from the richness of their sediment. Where the moraine splits vision into a multitude of epistemological views of glacier ice, the Leviathan Iceberg subsumes ice into a wholly destructive global oil regime—foreclosing the future rather than opening to its difference from our troubled epoch. It is our task, then, to use posture to struggle against this foreclosure and sustain the planetary future we saw at the moraine.

- 1 The Inuit people of Greenland are descendants of Thule people who migrated across the circumpolar North around 1000 CE.
- 2 Shari Fox Gearheard, Lene Kielsen Holm, Henry Huntington, Joe Mello Leavitt, Andrew R. Mahoney, and Margaret Opie, ed., *The Meaning of Ice: People and Sea Ice in Three Arctic Communities* (Hanover: International Polar Institute Press, 2013).

- 3 Jason Moore, "The Capitalocene Part I: On the nature and origins of our ecological crisis," *The Journal of Peasant Studies* 44, no. 3 (2017): 593–630.
- 4 Jodi Byrd, *The Transit of Empire* (Minneapolis: University of Minnesota Press, 2011).
- 5 We are invested in seeing how such postures might be negotiated collectively, or even globally. As Astrida Neimanis argues in her study of the

- shared conditions across bodies of water, there is a commonality that extends beyond epistemological standpoints and ontological differences to produce a more expansive and generous sense of who “we” are. Astrida Neimanis, *Bodies of Water: Posthuman Feminist Phenomenology* (London: Bloomsbury Press, 2016), 12.
- 6 We are especially attuned to Laruelle’s account of “subjects-in-struggle” in François Laruelle, *Introduction to Non-Marxism*, trans. Anthony Paul Smith (Minneapolis: Univocal, 2015).
- 7 Later that year, Noël joined us in Greenland for an interdisciplinary workshop on ice, where he attuned us to the media apparatus that calculates this surface mass balance: a coordination of satellite imaging, remote sensors and a super-computer that performs dense calculations of climate data.
- 8 In an interview, he recounted that he wanted to shift the boulder outside the circumference of *Broken Circle* but was told that it could only be moved by the Dutch Army. Smithson was perturbed by what he described as a cyclopean dilemma: a blind spot that blotted out the circumference. Robert Smithson, “Interview with Gregoire Müller,” in *Robert Smithson: The Collected Writings*, ed. Jack Flam (Los Angeles: University of California Press, 1996), 258.
- 9 In Smithson’s words, “... at eye level one tends to see the boulder as part of the circumference. The veritability of the boulder’s position is engulfed by curvatures—no fixity moderates...,” Smithson, 258.
- 10 Smithson, “Broken Circle—Emmen Holland (Script),” (1972) Robert Smithson and Nancy Holt Archives, Box 2, Folder 66, Archives of American Art, Washington DC.
- 11 Ole Bennike et al., “Mapping glacial rock flour deposits in Tasersuaq, southern West Greenland,” *GEUS Bulletin* 43 (2019).
- 12 Richard Grusin, *Premediation: Affect and Mediality After 9-11* (London: Palgrave Macmillan, 2010).
- 13 Bruno Latour, *Facing Gaia* (Cambridge: Polity, 2017), 1–18.
- 14 *Ibid.*, 4.
- 15 The title is a reference to a phrase in Barry Lopez’s bestselling novel *Arctic Dreams* about his travels across the Arctic in the 1980s.
- 16 As the cultural theorist Kirsten Thisted argues, the discourse of Indigeneity emanates from European and colonial mindsets, and comes with global pressures, that close Indigenous people between being civilization’s Other (a primitive) and a corrective to colonization’s discontents. Kristen Thisted, “Blubber Poetics. Emotional Economies and Post-Postcolonial Identities in Contemporary Greenlandic Art and Literature,” in *Sámi Art and Aesthetics. Contemporary Perspectives*, ed. Aarnold Svein, Elin Haugdal, and Ulla Angkjær Jørgensen (Aarhus: Aarhus Universitetsforlag, 2017), 267–297.
- 17 *Ibid.*, 269.
- 18 Jessie Kleemann, *Qivittoq* (Vejby: Hurricane Publishing 2012).
- 19 Conversation with Jessie Kleemann, June 2019.
- 20 *Ibid.*
- 21 Mark Watts, “Fujairah emerges as a strategic oil hub,” *Middle East Economic Digest* 56, no. 48 (November 2012).
- 22 Derek Baldwin, “Trial run for UAE iceberg project in 2019,” *Gulf News*, July 1, 2018.
- 23 “The icebergs are expected to cause a unique climatic phenomenon as the cold icebergs would attract clouds over the Arabian Sea, thus creating a climate vortex that will cause rainfalls. It would also assist in providing fresh water to the region, making the UAE a hub for exporting water to the world.” *Ibid.*
- 24 Abdulla Alsehi, *Filling the Empty Quarter: Declaring a Green Jihad on the Desert* (Morrisville, NC: Lulu Publishing Services, 2015).
- 25 At the Jameel Art Center for an exhibition curated by Murtaza Vali called “Crude.”
- 26 Patrick Wintour, “Saudi oil tankers show ‘significant damage’ after attack—Riyadh,” *The Guardian*, May 13, 2019.
- 27 Patrick Wintour, “Iran announces partial withdrawal from nuclear deal,” *The Guardian*, May 8, 2019.

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*Production or
Engendering?*

Bruno Latour

Researchers, activists, and citizens are speaking more and more about “getting away from the system of production.” The goal is no longer simply to replace the owners of this system, as it was in the communist era, by giving the proletariat ownership of the “means of production”; it is also not to more equitably distribute the profits of this cornucopia, as the social democrats have always tried. No, the demand is becoming more and more insistent, more and more urgent, and, especially since the public health crisis, more radical: it is the system of production *itself* that we must now get away from—and the very concept of the *production* of goods.

But what are we really trying to say with this? In what way is it a revolutionary pursuit? Why, for that matter, should we deprive ourselves of production, now that each of us lives surrounded by all the goods we’ve desired for so long, the possession of which enchants us? What is the reasoning for such an injunction now when an economic crisis, on the heels of the health crisis, throws millions of unemployed people onto the street? Why would we not rather see the “picking up of production” as quickly as possible?

There is certainly something rotten in the kingdom of production. As if it were, deep down, irreformable. As if, the opposite of King Midas, it destroyed everything it touched—after having turned it into gold. It seems, in fact, that the ecological mutation—which follows, surrounds, precedes, exceeds the health crisis—demands that we ask the question of an *alternative to production* and its role in a system that can be neither reformed nor revolutionized, but instead always carries on in the same direction and reinforces itself—as we risk seeing, alas, with the “economic resurgence” after *la Covid* (the feminine article is mandated by the Académie Française).

For a few years now, I have tried to stress the contrast between the system of production and what I suggest calling *practices of engendering*. Why? Because to speak about plural practices is to already remove oneself from the dangerous hegemony implied by the notion of a singular system: faced with a system that is too complete, too coherent to be modified in pieces, one can only bend to it or dream of bringing it down entirely; to confront it is to cut off one’s own arms and legs. In addition, to speak of engendering is to establish a distinction between the act of producing—which attributes the undertaking and the central role to the human agent—and the act of *contributing to the generation*—which shifts the center of gravity around other modes of action.

One could dispute the choice of this expression, but I find it has three advantages that at least justify using it to open the discussion.

Engendering contains *gender*, and this is no coincidence. The repression of all that has to do with genesis, care, and the maintenance of lifeforms is tied, in Western history, with elision, eviction, and the persecution of the feminine. There is thus a compelling

interest in critiquing the system of production through the lens of the immense ongoing project of feminism and, in particular, in understanding the invention of the economy as an unfolding masculinization—whose history is now partially complete. To “get away from” the system of production, is, by definition, to get back to the question of gender and the allocation of affects and expertise between them. It is also, more deeply, to reformulate the question of origin: from whom and from what are humans born?

Another advantage of speaking in terms of practices of engendering is that it forces us to situate in time and space the particular enterprise of systems of production.

Despite their apparent expansiveness, there is nothing universal about them. Anthropologists have worked hard to make readers in industrial societies understand just how inappropriate it would be to take the gardens of the Amazonian Indians, the farming of yams in New Guinea, the breeding of horses in the steppes of Tibet, and turn them into “more or less productive acts,” inserting them into a “system of production.” It’s not for lack of trying, of course. Economists, colonial administrators, and sociobiologists have indeed tried to make each of these practices of engendering “fit into” a kind of faux system of production, but, most often, the result has been to destroy such practices or render them incomprehensible.

We have to accept it: since the dawn of time, communities have procured their own wellbeing, have known relative abundance, have enriched themselves and prospered without their practices being qualified as the “production of goods.” On the contrary, resisting the pressure of economization has been essential. Hence, the idea that “we are not producing, we are participating in the engendering of combinations of lifeforms” would not be a bad way to describe that resistance.

The third advantage of this contrast is to embed the act of production within practices that render the act possible, but whose importance it otherwise *denies*.

The universal resistance to the notion of production, in fact, is not linked only to exotic terrains, to ancient societies, or to the margins of industrial societies. The sociology of work, and of organizations, has shown, for a long time now, how many *micro-inventions* have been necessary to advance an assembly line of cars or to carry out an order. Planning offices might be ignorant of what happens on the assembly line; the workers know perfectly well that the assembly lines, as roboticized as they are, would jam in a few minutes without their intervention. More generally, there is not a single course of action that does not require, at some point before it can be brought to fruition, a *restart* in each of its parts through an innovation, no matter how minuscule. All production unfurls, in fact,

because around and within it, countless practices of engendering allow us to see it through.

Thus, what we call the “system of production” is only ever one *single part* of what renders it possible, or, to use a perfectly suited word, its *viability* always and still today relies on what it cannot “take into account.” What one says of the invisible feminine work that renders visible production possible must also be said of the very notion of the “system of production”: it is, by definition, a form of organization that *ignores* or even *denies* the conditions through which it is accomplished. To return to an expression from Matthew 20:16, “so the first shall be last and the last first” (or a phrase popularized in France during the pandemic, “*pas de premiers de cordée, sans premiers de corvée*”). Or, to put it in yet another way, we call the “system of production” that which manages to extract a *value of engendering* that it doesn’t recognize—meaning a *surplus value of engendering* that is surreptitiously added to the surplus value of the labor theory of value in traditional analysis (and which, for that matter, explains its nature).

Evidently, these three elements must be further developed, but if I consider them as established, it’s because of the irruption in politics and in the media of what we could call “disturbances in the engendering.” I find it very indicative that, from the far right to the far left, political sentiments are no longer expressed in terms of their relationship to production (who from the State or from the Market should triumph; how to more equitably distribute goods; must we reform or revolutionize the economy; how to guarantee continued progress; whether to allow “the reopening”, etc.), but rather in terms of the risk run by the *genesis* of lifeforms. As if it were indeed an existential question, a question of the continuity of forms of “generations” that has become the heart of public life.

Never during the “Trente Glorieuses” would we have conceived of an activist movement that would be called the “Extinction Rebellion”—added to the rebellion of the former far left is henceforth this new shadow cast by the new risk of *extinction*. The temporal horizon has been completely modified by it. On the other side of the political spectrum, how can we not be startled by the appalling effort put into the fight against “gender theory” in the French academy—in addition to those against abortion and “marriage equality.” The threat of the return of gender is perfectly clear. As for the far-right fear of “the Great Replacement,” it seems to be the ideal symptom to perfectly designate the abyss of extinction. And what about the staggering spread of theories of collapse (oddly referred to as “collapsology”), which influence just about every political position? As if the risks run by the “genealogical principle” had become the common Vulgate and yet remained hidden from the general public.

Even the most reasonable iterations of ecologization use expressions such as “sustainable development,” “short circuits,” and “circular economy,” which all highlight the need to maintain the continuity of exterior “resources” used on top of production itself. More striking is the return of the question of land, of earth, of territory both in the most reactionary forms—the neonationalist imposition of borders of all kinds—as well as in the most progressive demands—the irruption of Gaia. In all their possible forms, the earth, the land, the planet emerge as “factors of production” that had been completely forgotten during periods of modernization.

Brusquely the question returns: “What earth will I be able to live on, and my descendants?” a question that echoes simultaneously on the left, in the center, on the far left, on the right, and on the far right. Even as we believe there to be a complete dispersal of political opinions, attention has unanimously shifted toward a new subject: *the end of the world*. In this sense, it is not certain that we must seek an alternative to the system of production: mentally, we have already gotten away from it. Except there is no shared definition of the alternative. That’s what justifies exploring the expression “the practices of engendering.” Is it a suitable way to bring about this new space of political representation? As if the opposition between practices of engendering and the system of production would be able to serve as a compass for us to identify the new political polarizations? It seems to me that these questions deserve to be posited now at a time when the world has witnessed, if not an end, then at least a brutal and completely unexpected halt of the entirety of its economy—before throwing itself, just as blindly, into “picking up” production again.

Translated by Emma Ramadan

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Jade Urbanism

Lindsay Bremner
and Beth Cullen

In Yangon, Myanmar, displays of conspicuous wealth adorn high-end real estate developments located at strategic downtown intersections and clustered around the city's famous Kandawgyi and Inya lakes. While there is nothing exceptional about these buildings—enclosed atriums, shopping malls, tinted glass office towers, hotels, and condominiums—these developments contrast sharply with the decaying colonial infrastructure, congested roads, and bustling open street markets around them. In 2018 and 2019 we spent time in two of these shopping malls, paying \$6.00 for barista-made cappuccinos, perusing the opulent interior décor replete with ambient lighting, fake ornamental tropical plants, and marble-lined fountains while circulating around atriums lined with international brands like Armani, Coach, Hugo Boss, and Versace. While the malls were not full, there was clearly a market for their products among wealthy Burmese nationals. The story of these buildings—who financed them, who built them, who frequented them, and how they related to the wider political economy of Myanmar—is the story of the murky dealings of the governing State Law and Order Restoration Council (SLORC) of the 1990s, the ceasefires it negotiated with insurgent groups along the Chinese border, and to the jade mines in the restricted northern state of Kachin.

Crony Capitalism

After the 1988 uprising in Myanmar, the military junta reinvented itself as the State Law and Order Restoration Council (SLORC) with a commitment to negotiating a new constitution as a precursor to democratic elections, to liberalizing and privatizing the economy, and to transitioning from socialism to a market-oriented economy.¹ The military used the liberalization process to its advantage, expanding its industrial base and extending its reach into the economy.² It established two large conglomerates whose majority shareholders were current or former military officers: Myanmar Economic Holding Limited (MEHL) and Myanmar Economic Corporation (MEC), both of which became closely linked to the extractive industries and through which the military continues to launder money.³ The 1990s also gave rise to a particular form of crony capitalism.⁴ In Myanmar, crony capitalism favors certain individuals with close connections to the military and who were selected by the SLORC as “national entrepreneurs” to benefit from the transfer of state assets.⁵

Ceasefire Capitalism

While the SLORC was selling off the state's assets to itself and its cronies, it was negotiating ceasefires with insurgent groups along the border with China, where some of Myanmar's most profitable resources—Burmese teak, jade, and drugs—are found or produced. Historically, these highland areas remained peripheral to the state apparatus and semi-independent from lowland centers of power.⁶ Struggles between distinct ethnic groups who inhabit the remote uplands and the Burmese state go back for centuries, but were exacerbated during World War II when the British recruited civilians from upland Kachin, Karen, and Shan groups to fight against the Japanese, while the fledgling Burmese Independence Army was trained by and allied itself with the Japanese.⁷ Conflicts were compounded in 1949 when Chiang Kai-shek's retreating army, backed by the CIA and Thailand, marched into Burma from Yunnan, the Chinese province neighboring Myanmar. This resulted in a complex web of postindependence conflicts between the Burmese army, Chinese nationalists, and ethnic militias fighting for autonomy or independence or for control over opium and heroin cartels.

At the same time, the militias of the Burmese Communist Party were fighting for a People's Republic of Burma backed by China. Then came reform in China under Deng Xiaoping and, in 1989, the Burmese Communist Party collapsed. This opened the way for ceasefire deals between the Burmese army and the communist militias and eased relations with China. Tight Western sanctions were in place at the time and the World Bank and UN had cut off aid to Myanmar, which led the SLORC to turn to Beijing to develop the infrastructure it had promised in ceasefire deals, creating a favorable environment for Chinese aid and business. China began to pour billions of dollars into new infrastructure in Myanmar and set up hundreds of factories over the border producing consumer goods for the Burmese market. Today, Chinese businesses dominate much of Myanmar's economy.⁸ Ceasefire agreements with other insurgent groups in the country soon followed. In Kachin, the Burmese Army and the Kachin Independence Army (KIA) agreed a ceasefire that included jade mining concessions for military-owned companies and crony businesses on both sides. Ceasefire capitalism and crony capitalism overlap.

Jade Mining

Kachin's jade is found in a fifteen-kilometer-long belt of conglomerate rock along the Uru River centered on the town of Hpkant.⁹ The conglomerate was transported and deposited over thousands of

years from primary jade dikes on the Tawmaw Plateau to the northwest.¹⁰ These deposits are of the jadeite variety, a rare, harder, and more valued form of jade than the softer, more common variety, nephrite. Imperial jade, distinguished by its color and transparency, is the most valuable of all jade varieties and has only ever been found in the Kachin deposits. The main source of demand for Myanmar's jade is China, where the stone has assumed great cultural importance over the last five thousand years. In Confucius's *Book of Rites*, jade was associated with no less than eleven virtues—benevolence, justice, propriety, truth, credibility, music, loyalty, heaven, earth, morality, and intelligence—giving it symbolic and quasi-mystical powers as well as monetary value.¹¹

Kachin jade has been mined and traded with China since the thirteenth century, but significant extraction only began in the second half of the eighteenth century when Yunnanese traders transported it from Kachin along mule caravan routes that formed part of the ancient Silk Road.¹² During British rule, jade mining was regulated and overseen by an Administrator of Mines, but because jade was of no interest to the British (their primary interests in Burma were teak, oil, and rice), the jade trade continued almost unhindered.¹³ In the 1960s, jade mines were closed to foreigners and private mining, and the trade of gemstones became illegal. The introduction of the Myanmar Gemstone Law in 1995 allowed jade extraction and trade to begin again.¹⁴ While Western nations boycotted Myanmar, China re-opened its borders and trade between the two countries exploded. As a result, jade mining increased exponentially, officially generating an estimated US\$122.8 billion between 2005 and 2014, and US\$31 billion in 2014 alone when production peaked, an amount equivalent to forty-eight percent of Myanmar's GDP.¹⁵

The growth in revenue from jade mining was partly due to the transformation of the mining process itself, which until the 1990s had been small scale and artisanal.¹⁶ Once Myanmar's military became involved, mining processes were mechanized and operated at an industrial scale. Dike and blast mining were introduced on the Tawmaw Plateau, sophisticated equipment was brought in for mountaintop removal, and large-scale boulder and gravel mining continued in the Uru Valley. All of these techniques required significant investment and squeezed out artisanal miners.¹⁷ However, industrialization attracted a surge of unregistered jade diggers known as "hand-pickers" or *yemase* (meaning "unwashed stones") from around the country to eke out a living by picking out jade from mine tailings.¹⁸ Up to two hundred thousand of these young men between the ages of sixteen and thirty live in makeshift tents around the mines during the dry season when formal mining operations are underway, shrinking to about five thousand during the rainy season.

Their work is highly dangerous as tailings are enormous, unstable, and prone to liquefy and collapse in the rain. The deadliest such accident to date occurred in July 2020, when tailings collapsed into a lake formed by monsoon rains and created a wave of mud and water that swept 174 miners to their death and left one hundred unaccounted for. As well as its human cost, industrialized mining has rendered the Uru Valley unrecognizable. Excavation and drilling have fissured the earth and turned mountains into craters. This is visible in satellite imagery, with scars in the landscape appearing in the 1990s and accelerating from the mid 2000s onwards. The Uru River, once flowing freely through the Hpakant Valley, is now obstructed by mining waste and severely polluted.¹⁹

Distribution Networks

Once mined, jade has many routes into Chinese markets. The only legal way to buy unprocessed high-quality jade from registered sources is at the official government emporium in Naypyidaw.²⁰ The official Gems Emporium is held once a year in Mani Yadana Jade Hall, during which time jade sales spill over onto a vast parking lot adjacent to the main building. Emporium sales are subject to tax, and only after stones are taxed can they be legally exported.²¹ Lower-grade jade can be sold legally at jade markets in Mandalay and Yangon.²² The biggest of these is the Mahar Aung Myay Market in Mandalay, which during peak periods hosts an estimated forty thousand buyers and sellers in a sprawling, crowded labyrinth of arcades accessed through heavily guarded gates. Yunnanese and Chinese brokers inspect stones for their quality with small flashlights and communicate with buyers in China via WeChat and live video streams.²³ The arcades overflow into endless market floors where jade and other stones are laid out for sale, and which lead into back-of-house cutting and polishing operations.

To avoid the costs incurred via legal routes, companies smuggle an estimated fifty to eighty percent of their jade directly to China, bypassing official controls on both sides of the border.²⁴ There are two main routes for this: via Myitkyina, the capital of Kachin State, and along dirt paths, rivers, and roads to a number of small towns along the Chinese border, or from Mandalay via Muse, the capital of Shan State, to the Chinese border town of Ruili. Ruili is the largest of the Chinese border towns and a key hub for jade and drugs. Burmese historian Thant Myint U visited it in the 1990s, when it was a small and backward place, selling very little except Burmese jade (even then) and other contraband. When he visited it twenty years later, it was a town of wide palm-tree-lined boulevards and glass fronted shops selling Armani and Rolex.²⁵ The expansion

of the jade sector had not only transformed the city into a hub for the processing and exchange of jade, but also a convenient place to launder money. With major private sector investment in construction and infrastructure, property development was booming (property prices were said to be equal to those in Shanghai or Beijing).²⁶

Jade Urbanism

Significant changes to Myanmar's Property Tax Law in 2007 reduced real estate taxes from a prohibitive fifty percent to twelve or fifteen percent and removed the need to demonstrate origins of income.²⁷ These amendments made it easier for illicit capital to enter the real estate market. Those who had made undocumented fortunes seized the opportunity to convert cash into real estate.²⁸ Changes in the property tax laws preceded the shift of the nation's capital to Naypyidaw, a lucrative move for crony companies such as Asia World, Max Myanmar, and the Htoo Group, who were awarded contracts for its construction. The relocation of the capital to Naypyidaw enabled the sale of the land and vacant buildings in Yangon that government ministries and departments owned or in which they were formerly housed.²⁹ Beginning in 2010, hundreds of government properties were put up for auction.³⁰ This sell-off, the largest in the country's history, was taken up by military elites and crony companies, consolidating their economic position in advance of the 2011 elections.

Many of the high-profile new developments that we witnessed in Yangon were closely tied to these developments. Ruby Mart, the first shopping mall built in Yangon on the corner of Pansodan Street and Bogyoke Aung San Road, is owned by the military conglomerate Myanmar Economic Holding Limited (MEHL) and stands on a site that once housed the Ministry of Commerce's Myanmar Agricultural Produce Trading.³¹ MEHL controls large tracts of the best Kachin jade land, with many of the main jade mining companies in Hpakant working as its subcontractors.³² The crony company Asia World Group, run by Steven Law (the son-in-law of Lo Hsing-han, a 1970s opium warlord), worked with the Yangon Development Committee to upgrade Strand Road in downtown Yangon and improve access to its Asia World Port Terminal, which handles a large proportion of Yangon's cargo.³³ Asia World also financed and built the luxury Sule Shangri-La Hotel on Quartermaster General Office-owned land on the corner of Bogyoke Aung San and Sule Pagoda Roads. Asia World Group is one of the largest companies in Myanmar and formerly operated the Hpakant jade mining company Yadanar Taung Tann Gems.³⁴ The Kanbawza Group (KBZ) owns Strand Square, an office complex in the center of Yangon's financial district. It operates

and owns the biggest private sector bank in Myanmar, KBZ Bank, whose branches pepper the country. A company brochure in 2017 featured images of KBZ mines in Hpakant and details of jade sales at official emporiums amounting to millions of dollars.³⁵ According to the KBZ senior managing director, “jade mining is the company’s first business and a prime and legal source of income for other businesses in the conglomerate.”³⁶

Another crony company, Max Myanmar, owns Yangon’s 366-room Novotel Hotel and acquired a sixty percent stake in Pyay Tower, a prominent state-led development that includes a shopping center, offices, and apartments.³⁷ Max Myanmar initially made money importing cars to Myanmar before consolidating ties with the military. It ran the Moe Pin mine in Kachin, a joint venture with Myanmar Gems Enterprise, where the largest piece of high-class jade ever found in Myanmar was discovered in 2010.³⁸ Another company, the Htoo Group, is developing a 21.9 acre site in downtown Yangon that will include a four-star hotel, an apartment complex, and a shopping mall.³⁹ Htoo Group is owned by Tay Za, who was the chairperson of Myanmar’s Association of Gem Industries for six years from 2008 to 2014.⁴⁰ The list of real estate ventures by crony companies could go on and on, but even this abbreviated one confirms the links between cronyism, jade, the state, and glittering real estate ventures in Yangon. Often built as favors to state authorities in return for further concessions, real estate became a way of offloading cash and consolidating influence while catering to the consumptive lifestyles of ultra-rich business elites.⁴¹

Many of Myanmar’s military conglomerates and crony companies today are diversifying their business interests away from jade towards the infrastructure and energy sectors, which in Myanmar are dominated by Chinese interests. While mining jade for Chinese markets will continue to be lucrative, getting in on the act of servicing China’s energy needs will be even more so. As part of its Belt and Road Initiative, China has planned an economic corridor running from Kunming, the capital city of Yunnan, through Ruili to Mandalay. From Mandalay, the corridor forks southwards through Naypyidaw to Yangon and westwards to Kyaukphyu in Rakhine State. In Yangon, an agreement has been signed by the Yangon Regional Government with the Chinese state-owned China Communications Construction Company to build the infrastructure for New Yangon, a 8,000-hectare development west of the city, in exchange for 2,800 hectares of land there, which amounts to thirty-five percent of the land available for development.⁴² In Kyaukphyu, a new special economic zone (SEZ), oil terminal, and deep sea port is under construction.⁴³ Kyaukphyu has enormous strategic value to China. It will provide landlocked Yunnan access to the Bay of Bengal, resolving what President Hu Jintao called the

“Malacca Dilemma” and will strengthen China’s presence in the Indian Ocean.⁴⁴ The corridor includes ports, highways, railways, power plants, and, more importantly, a 2,380-kilometer pipeline to transport oil and gas from Rakhine to China’s inland mega-city, Chongqing. Crony companies including Asia World Group, KBZ, and Max Myanmar have already been awarded infrastructural tenders along the corridor.⁴⁵ It has been suggested that one of the motives for the Rohingya displacement in Rhakine State was to clear the land for these operations and enable easier access to the state’s resources.⁴⁶ China is thus not only consolidating its power over Myanmar’s political economy and transforming its territory, it is ensuring that Myanmar’s resources are further aligned with its strategic interests in the region and beyond.

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*Climatic Privilege and
Transnational Labor
in Singapore*

Jennifer Ferng

In 1963, Prime Minister Lee Kuan Yew (1959–1990) called Singapore a “society in transition,” pushing the country on an upwards trajectory towards modernization and a place on the world stage.¹ Now, four decades later, Singapore persists as a divided multicultural society where inequality is evident in national policies towards skilled and unskilled foreign laborers. While the city-state pursues economic expansion marked by security, stability, and prosperity, these social benefits are mostly enjoyed by Singaporean citizens, and not equally distributed among its permanent and transit populations.

After the Cold War, Singapore was positioned as an anchor for intra-Asian operations by Western neoliberal democracies such as the UK, US, and Australia. In contrast to countries like Malaysia, where Malay workers were increasingly mobilized by the Malayan Communist party, the Singaporean government established noncommunist labor unions with support from the US.² As Singapore’s urban density increased with rising populations of skilled and unskilled foreign workers, these same workers became a point of contention for politicians, construction developers, and activists in relation to the nation’s economic and immigration policies. Where Singapore’s new buildings and infrastructure represented its financial affluence, the growing body of foreign laborers that built them became stigmatized as embodiments of Singapore’s “addiction to cheap labor.”³

Today, uneducated workers from Bangladesh, China, India, Malaysia, the Philippines, Thailand, and Vietnam arrive in Singapore with temporary visas to work in the construction and maritime industries. Around two hundred thousand unskilled workers are currently housed in forty-three state-regulated dormitories located in scattered urban locations. Overseen by the Singaporean government, these sites undergo frequent legislative changes in response to the evolving needs of employers and migrant workers. Worker housing is often relegated to sites next to petrochemical manufacturing industries, far from central neighborhoods. In the western district of Tuas, for instance, facilities for foreign workers—bedrooms, canteens, markets, communal facilities, and light-rail transportation—are located near the PUB Tuas South desalination plant. Another ninety-five thousand unskilled workers live in 1,200 factory-converted dormitories managed by diverse employers around the city, and an additional twenty thousand construction workers are provided with on-site housing by companies trying to reduce costs as much as possible.⁴

Climate change intersects with the forced displacement of migrants to reinforce existing inequalities of ethnicity, class, and citizenship. Poorly planned and provisional housing for transient workers is erected in a way that prioritizes state and economic efficiency over the living conditions of its inhabitants. Segregated dormitories are designed with little regard for the context of tropical climates,

and often lack air conditioning or shaded outdoor areas. As tropical countries cope with hotter temperatures and higher levels of humidity, building standards around climatic design are becoming increasingly important. While affluent city dwellers continue to visit air conditioned spaces around Singapore, the inequity apparent in the design of worker dormitories continues to feed the growing gap in environmental discomfort between migrants and citizens.

By 2030, Southeast Asia's worker productivity is predicted to decrease by eleven percent due to global warming.⁵ Human capital inflected by "Asian values"—namely, the preference for societal stability over personal freedom—is administered at the whims of the Singaporean government, for whom migrants' labor is essential for the country's growth.⁶ At the same time, these migrants are rendered powerless within planning systems that assign reduced living standards to foreign workers. The collision of human capital, climatic design, and migration policies has created an untenable situation in twenty-first-century Asia.

As a result of such collisions, the complex nexus between financial power, industrial manufacturing, and unparalleled construction growth has also served to widen the gulf between Singapore's rich and poor, between Chinese, Malays, and Tamils, between permanent and transient populations. These socioeconomic and environmental trends converge forcefully in the workers' purpose-built dormitories (PBDs). In this context, "climatic privilege" is an operative category consisting of power structures, technologies, and legal definitions of residency that determine who may apply for specific types of housing, schools, and jobs.⁷

Climatic inequalities are not only derived from systems of the technoscientific state. They also become visible at the level of buildings, where regulatory laws and building codes increase the precarity of vulnerable groups like unskilled laborers. In fact, some of the same mechanisms that make Singapore financially secure are used as legislative tools against the legal interests of migrant workers. By coupling financial interests with deliberate urban zoning, both policymakers and construction and petrochemical companies dictate how and where low-wage laborers may live.

Architecture is complicit here in reducing basic living amenities for migrant workers on building sites, in factories, and in petrochemical industries. Not only are air conditioning, shading, or other amenities rarely provided in the design of PBDs, but state legislation limits improvements that would make these buildings more bearable in the tropical heat and humidity in the name of cost efficiency. Born from the merger of corporate and government regulations, the climate inequalities materialized in the designs of worker dormitories facilitate greater exploitation of laborers, who endure hotter temperatures without sufficient legal protection.

Zones of Exemption

The legal jurisdiction to designate residential zones for migrant workers is rooted in Lee Kuan Yew's efforts to modernize Singapore's government beginning in 1974. By setting up a "government that runs like a corporation," Lee transformed Singapore into the "Zürich of the East."⁸ School curricula and foreign relations were carefully measured in terms of cost-effectiveness. Known as a democratic socialist, Lee crafted Singapore into a "rugged society" where multinational corporations supplied the island city-state with "capital, expertise, and export markets"—an economic policy that has endured into the present.⁹

Singapore's "non-aligned foreign policy" makes it a useful ally to a number of foreign powers.¹⁰ Through bilateral trade agreements, it has encouraged Saudi Arabia and the United Arab Emirates to provide crude oil for its local refineries in exchange for their investment in Singaporean industries. Recent estimates for Singapore's exports are based on growth forecasts of trade with its largest partner, China. Oil is also Singapore's second largest export commodity to the US, valued at US\$616 million in 2020.¹¹ Such numbers demonstrate the scale of influence held by petrochemical manufacturers in Singapore. Under Lee, the government also moved aggressively into profitable enterprises by investing in shipyards, banks, hotels, steel mills, and even substantial stock shares of other companies located in diverse sectors.

The city-state approaches migrant workers, their places of residence, and legal rights as economic assets that require close governance. Government legislation in Singapore standardizes which types of basic services can be provided in workers' housing, but does so primarily in consideration of potential long-term impacts on Singaporean citizens. Any urgency to act on improvements for foreign workers is weighed against these other, and often contradictory, priorities.

Compared to Singapore, some megacities like Manila are making better attempts to provide environmental comfort for all types of residents in response to climate change. However, "energy poverty"—which goes beyond monetary terms—continues to be a significant problem in Southeast Asia. Access to energy services remains a pivotal issue: some households are unable to tap into an electrical grid or reach markets where they can purchase electrical equipment.¹² This trend is exacerbated for rural residents and foreign workers since both groups are unable to choose where they may live in expensive cities like Singapore.

Inequality by Design

The immigration of low-skilled workers remains instrumental to finance and industrial production in Singapore. Not only do migrant workers supply a large source of seasonal and project-based labor, but they are also perceived as a source of human capital that expends a portion of the limited resources belonging to Singapore. Foreign workers constitute at least 35.2 percent of Singapore's total workforce of 2.99 million as of December 2009.¹³ In 2019, this figure increased by at least 284,300 workers from the construction sector alone.¹⁴ As such, worker housing links the large-scale manufacturing critical to Singapore's economy to the management of migrant populations that is key to government policy. These buildings accordingly fall under the remit of at least four government agencies: defense, environment, labor, and urban planning.

The Employment of Foreign Manpower Act of 2007 and the Foreign Employees Dormitories Act of 2015 are two major legal measures enacted to regulate migrant worker dormitories. The latter act pertains to "boarding premises" that provide up to one thousand beds for residents who are foreign employees. According to the 2015 Act, newer industrial zones must include spaces for worker dormitories and corporate parks, specifically in the technology sector. However, these mixed use zones have not considered the transportation needs of the large numbers of migrant workers who live full-time in these districts. Needless to say, clustering dormitories and industrial parks together on the outskirts of Singapore does not necessarily foster a strong sense of local community for these workers.

Within this context, developers play an active role in selecting key sites for their dormitories. As the second largest operator of dormitories in Singapore and Malaysia, the Westlite company (owned by Centurion) strategically chose five locations across the city and engaged in long-term land tenures for investment stability before 2011. Westlite's hardline positioning, for example, allows it to keep up with the "increased costs associated with regulatory requirements," covering at least twenty-eight thousand beds for workers. The remaining four thousand to five thousand beds in this sector are managed by twelve other dormitory providers, giving Westlite a dominant share of the accommodation market.¹⁵ Toh Guan, one of its first dormitories containing 5,300 beds, opened in 2011 as Westlite continued to acquire strategic parcels of land near industrial parks as their portfolio of buildings expanded to the present day.

Some employers shun these dormitories for costly reasons, preferring to house their workers on construction sites in "cheap, makeshift shelters" that are legal as long as they are deemed

“structurally safe.”¹⁶ Before the National Environment Agency (NEA) and Urban Redevelopment Authority (URA) became part of the Ministry of Manpower’s 2015 legislation on worker dormitories, construction companies possessed more leeway to choose any type of temporary accommodations for their workers. Previously, migrant workers could be found living in partially completed office buildings and storing their belongings in unfinished rooms. In 2016, in an effort to reduce pressures on existing infrastructure in industrial areas with large numbers of worker dormitories, the URA expanded the list of industrial areas where new buildings could not be erected.¹⁷

Meanwhile, the NEA is concerned with worker housing, dormitories, and hostels alike from the perspective of health protections, and mainly addresses “lapses in hygiene that could cause infectious diseases.” Cleaning programs, refuse management systems, and hygienic food preparation are closely monitored.¹⁸ The environmental guidelines for dormitories mandate a minimum of 4.5 square meters in gross floor area per worker, including basic living facilities, sleeping quarters, kitchen, dining, and toilet areas.¹⁹ This type of discretionary authority does not specify design elements such as designated rooms for sleeping or recreation, or circulation spaces like corridors, elevators, or stairwells.

Only the most rudimentary standards are outlined. Workers’ bedrooms should be “adequately ventilated and lighted.” Toilet facilities should include a water closet, urinal, hand wash basin, and a shower room. Cooking areas must be compartmentalized and placed at least five meters away from any external walls, above ground, with a roof overhead, and a raised floor slab set up with proper drainage. There is no mention of electrical outlets for fans or other basic appliances. Cooking areas must, however, contain a proper wash area and refuse bins for waste. There are specific guidelines for the management of mosquito breeding grounds. Contractors and developers are “strongly encouraged” by government agencies to provide additional amenities like a sickbay, laundry washing, drying area, and collection points for waste within their compounds. There is no mandate to include air conditioning or a cooling system of any kind.

Built Enclaves, Legal Exclusions

Near the Straits of Johor, worker dormitories in Tuas and other sites around Jurong Island could easily be mistaken for any other industrial district, like the three-to-four-story bright blue and neon green prefabricated buildings situated alongside the road on the western edge of the Lion City. Owned by developer TS Group in 2014, the Tuas View Square dormitory is one of the first and largest

purpose-built dormitories for foreign workers, home to around five thousand residents. Spanning 8.4 hectares, the complex includes twenty four-story blocks, with recreational and service facilities including ATMs, an international money transfer service, medical and dental clinic, supermarket, gym, soccer court, beer garden, cinema, barber, clothing shop, and communal cooking facilities. Beyond the diverse amenities of the compound, its residents are paid SG\$600 per month on average as a living stipend on top of their housing costs (as of 2016).²⁰ For a worker like R. Madhavan, who created the short film *Salary Day* (2020), a portion of his salary (SG\$450) is sent back to his family as a remittance. The rest is used for buying groceries, prepaid meals, and topping up his phone card, leaving almost nothing left.²¹

Like the buildings erected by competitor Anderco, most of the TS housing blocks are built around a core of prefabricated systems. The generic slab buildings are fitted with narrow wall panels and a small number of shuttered windows. Many sleeping areas have only exterior ventilation slats. Bright blue balconies punctuate the railings and structural frames of the housing blocks, the sole component of a colorful visual identity. The migrant dormitory entryways are built as security checkpoints, and the exterior areas of the buildings are completely fenced in.

Inside, as many as twelve men may sleep in a single bedroom, sharing one or two ceiling fans. Shared bedrooms sometimes measure approximately thirty-nine by twenty-five feet, and are connected to a communal bathroom with a handful of toilets and sinks.²² The entryway into each unit includes a round dining table with only four chairs. Outdoor dining and cooking areas with tables and gas burners are minimally covered and left open to the air at one end. Some passive cooling takes place through cross breezes, but without central air conditioning, there is little comfort for migrant workers sleeping in overcrowded prefabricated modules. This is somewhat ironic, given Lee's promotion of air conditioning as a modern technology that would transform Singapore's productivity. Furthermore, the accumulation of air conditioners used in signature buildings only expels greater amounts of heat and humidity into the ambient environment where migrant workers toil.

In the process construction and maintenance sector, newer mixed-use dormitories are even more specialized. The ASPRI Westlite dormitory, built in 2018 for SG\$200 million, combines housing for 7,900 residents with an integrated training center in Jalan Papan, Jurong East. Here, workers who commute to Jurong Island can save up to two hours per day by completing their subsidized courses and training exercises at home, a measure that not only reduces costs for employers but benefits corporations as well.

Newsletters and mass e-mails are sent to workers explaining how much leisure time they can gain by living closer to construction sites. Westlite Woodlands holds weekly yoga classes for workers and sponsors excursions to Universal Studios Singapore and nearby Malaysia. Like other corporations, Westlite uses extra amenities to keep their workers content while living as close as possible to construction sites, keeping overall transportation costs to a minimum.

Worker Happiness?

Recent online advertisements for Tuas dormitory rooms feature slightly blurry photographs taken in cramped, narrow hallways: a communal bedroom with stacked rows of sparsely furnished bunkbeds scattered with random belongings; a wall with single strip window meeting an exposed ceiling—living quarters with harsh lighting, inadequate ventilation, and concrete slab floors. One image depicts the bare efficiency of a communal kitchen, its rows of stainless steel tables equipped with portable burners. Many advertisements on Gumtree or CommercialGuru show windowless rooms with holes sawn into the walls for ventilation.

The structure, design, and interior climate controls of worker dormitories should be treated and maintained as national assets. They embody an economic ecosystem rapidly expanding beyond the Singaporean government's limits, posing a threat of precarity to the financial health of the construction and petroleum industries. But as long as worker dormitories and their government-regulated amenities are considered a privilege, rather than a guaranteed right, then migrant workers will have little recourse to demand better treatment.²³

The legal language of economic opportunity used by the Singaporean government cloaks a deeper agenda: without the labor of migrant workers—the “human capital” so critical for the country's financial security—there would be no one to erect the contemporary skyscrapers that have made the city-state so profitable. The accumulation of migrant workers in Singapore points to the industry negotiations and tradeoffs that Lee Kuan Yew carefully weighed when introducing corporate practices into Singaporean government.

Migrant workers have, meanwhile, been used in self-congratulatory media campaigns for the Singaporean government, where they are depicted as an active and engaged sector of society. The Ministry of Education promotes Singapore as a “global schoolhouse” for English speakers, aiming to attract a diverse selection of international students. Undergraduates from the National University of Singapore (NUS) even volunteer their time to share food with migrant workers.

Migrant workers are visualized as a worthy social cause, but they are rarely accepted as permanent residents of Singaporean society and certainly not as Singaporean citizens. In the entanglements between financial stability and urban growth, they inhabit the apex of economic aggregation and human accumulation, where citizenship trumps transitory visas. Even as differential treatment rears its head, the Asian values once propagated by Lee Kuan Yew as a cohesive form of national harmony are now fortified by Singapore's brand of neoliberal injustice.

Thanks to Nick Axel, Daniel Barber, and Erik L'Heureux for comments on earlier drafts of this essay.

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advocating for migrants’ rights, see the websites of Humanitarian Organization for Migration Economics (HOME) and Transient Workers Count Too.

Biographies

Emily Apter is Professor of French and Comparative Literature at New York University and currently serves as Vice-President of the American Comparative Literature Association. Her most recent books include *Against World Literature: On the Politics of Untranslatability* (2013); *Dictionary of Untranslatables: A Philosophical Lexicon* (co-edited with Barbara Cassin, Jacques Lezra and Michael Wood) (2014); and *The Translation Zone: A New Comparative Literature* (2006).

Nick Axel is deputy editor of e-flux Architecture, head of the architectural design department at Gerrit Rietveld Academie in Amsterdam, and curator at the Babyn Yar Holocaust Memorial Center. He is editor of the books *Superhumanity: Design of the Self* (2018) and *Superhumanity: Post-Labor, Psychopathology, Plasticity* (2018) with Beatriz Colomina, Nikolaus Hirsch, Anton Vidokle, and Mark Wigley; *Work, Body, Leisure* (2018) with Marina Otero Verzier; *Permanent Temporariness* (2018) with Maria Nadotti; *The New Normal* (2020) with Benjamin H. Bratton and Nicolay Boyadjiev; *How Beautiful Are Your Dwelling Places, Jacob* (2021); and *Babyn Yar: Past, Present, Future* (2022) with Nicholas Korody.

Daniel A. Barber is an associate professor of architecture and chair of the PhD program at the University of Pennsylvania. He researches historical relationships between architecture and global environmental culture, reframing the means and ends of architectural expertise towards a more robust engagement with the climate crisis. He is the author of *A House in the Sun: Modern Architecture and Solar Energy in the Cold War* (2016) and *Modern Architecture and Climate: Design before Air Conditioning* (2020). He has held fellowships at the Harvard Center for the Environment, the Princeton Environmental Institute, the Sydney Environmental Institute, and through the Alexander von Humboldt Foundation. Barber is a cofounder of *Current*,

a platform for the discussion of environmental histories of architecture, and is a member of the Higher Education Advisory Team of the American Institute of Architects.

Hans Baumann is a Swiss-American artist and land art practitioner. His work addresses the decolonization of Western epistemologies, narratives of ecological collapse and nonhuman timescales. Baumann holds degrees in landscape architecture and human geography from the Harvard University Graduate School of Design and Prifysgol Caerdydd. His projects have been supported by a wide range of institutions, including the National Endowment for the Arts, the Antipode Foundation for Radical Geography, Strelka Institute and the Getty Foundation. Baumann has been an artist-in-residence at the Center for Land Use Interpretation (CLUI) and ArtCenter College of Design, and he is a Fellow of the Landscape Architecture Foundation. Hans currently resides in Los Angeles.

Amanda Boetzkes is Professor of Contemporary Art History and Theory at the University of Guelph. 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 editor of *Heidegger and the Work of Art History* (Ashgate, 2014). She has published in the journals *Afterimage*; *Postmodern Culture*; *Art Journal*; *Art History*; *Polygraph*; and *South Atlantic Quarterly*, among others. Recent book chapters appear in *Nervous Systems: Art, Systems, and Politics Since the 1960s* (2021); *Climate Realism: The Aesthetics of Weather and Atmosphere* (2021); *The Edinburgh Companion for Animal Studies* (2017); and *Art in the Anthropocene: Encounters Among Politics, Aesthetics, Environments and Epistemologies* (2015). Her current research considers modes of visualizing environments in the circumpolar North.

Biographies

Dominic Boyer is an anthropologist who teaches at Rice University, where he also served as Founding Director of the Center for Energy and Environmental Research in the Human Sciences (2013–2019). 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 around the world. During 2021–2022 Boyer will be a Berggruen Fellow with a research project, "Electric Futures," which focuses on efforts to decarbonize the global economy via greater electrification.

Lindsay Bremner is a research architect in the School of Architecture and Cities at the University of Westminster, London.

Nerea Calvillo is an architect and researcher, assistant professor at the Centre for Interdisciplinary Methodologies at the University of Warwick, and founder of C+ arquitectos and *In the Air*.

Wendy Hui Kyong Chun is the Canada 150 Research Chair in New Media at Simon Fraser University. She has studied both Systems Design Engineering and English Literature, which she combines and mutates in her current work on digital media. She is currently Visiting Scholar at the Center for Media@Risk at the Annenberg School of Communications, University of Pennsylvania.

Beth Cullen is an anthropologist and visiting lecturer at the School of Architecture and Cities at the University of Westminster. She was recently a postdoctoral research fellow for the ERC-funded project Monsoon Assemblages. Her work explores human-environment relations using ethnographic and participatory visual and spatial research methods. Following her PhD research with semi-nomadic pastoralists in the Rift Valley, she spent three years working on applied natural resource management and sustainable farming projects in Ethiopia. Beth's research interests include environmental anthropology, more-than-human ethnography and participatory approaches for working with complex socioecological systems.

T. J. Demos is an award-winning writer on contemporary art, global politics, and ecology. He is Professor in the Department of the History of Art and Visual Culture, at University of California, Santa Cruz, and founder and director of its Center for Creative Ecologies.

Jeff Diamanti is Assistant Professor of Environmental Humanities at the University of Amsterdam. He is the author of *Climate and Capital in the Age of Petroleum* (Bloomsbury, 2021).

Jennifer Ferng is Senior Lecturer in Architecture and Postgraduate Coordinator at the University of Sydney. She received her PhD from MIT. Her research examines migrations of asylum seekers and refugees in Oceania and Southeast Asia against the context of the detention industrial complex. She has addressed the role of the built environment in offshore processing regimes from Australia and Papua New Guinea to Cambodia and Indonesia. Ferng belongs to the Sydney Asia Pacific Migration Centre and has been a visiting scholar at the Harvard University Asia Center. In 2021, she is a visiting research fellow at the UCL Institute of Advanced Studies, based at the Department of Geography's Migration Research Unit. During her residency, she is collaborating with Professor Elena Fiddian-Qasmiyeh on refugee communities in the Middle East and Asia.

Jennifer Gabrys is chair in Media, Culture and Environment in the Department of Sociology at the University of Cambridge. She leads the Planetary Praxis research group, and is Principal Investigator on the ERC-funded project *Smart Forests: Transforming Environments into Social-Political Technologies*. She also leads the Citizen Sense and AirKit projects, which have both received funding from the ERC. She writes on digital technologies, environments and social life, with recent publications including *How to Do Things with Sensors* (2019) and *Program Earth: Environmental Sensing Technology and the Making of a Computational Planet* (2016). Her work can be found at planetarypraxis.org and jennifergabrys.net.

Ian Gray is a PhD student in sociology at the University of California Los Angeles and a visiting predoctoral fellow at the Max Planck Institute for the History of Science in Berlin.

- Gökçe Günel is Assistant Professor in Anthropology at Rice University. Her latest book *Spaceship in the Desert: Energy, Climate Change and Urban Design in Abu Dhabi* (Duke University Press, 2019) focuses on the construction of renewable energy and clean technology infrastructures in the United Arab Emirates, more specifically concentrating on the Masdar City project. Currently, she is completing a second book manuscript provisionally titled *Energy Accumulation*, which looks at a floating power plant in Ghana. In her collaboration with Saiba Varma and Chika Watanabe, *Patchwork Ethnography*, she seeks to draw attention to how researchers' lives affect the processes of anthropological knowledge production.
- Orit Halpern is an associate professor of interactive design in the Department of Sociology and Anthropology at Concordia University, Montreal. Her research explores the histories of digital technologies, cybernetics, the human and cognitive sciences and design, with a particular focus on the histories of big data, interactivity and ubiquitous computing. Halpern's recent book, *Beautiful Data: A History of Vision and Reason since 1945* (Duke University Press, 2014), is a history of the interface, interactivity and big data.
- Gabrielle Hecht is Professor of History and (by courtesy) Anthropology at Stanford University. Her current research explores radioactive residues, mine waste, air pollution, and the Anthropocene. In *Being Nuclear* (2012), she focused on African uranium mines and miners to show how the "nuclear" is a fluid category of power throughout the world. The book received awards in history, sociology, STS, African studies, and general humanities, and has been translated into French and Japanese. She is also the author of *The Radiance of France* (1998/2009) and numerous articles, most recently in *Cultural Anthropology*, *Aeon*, and *Politique Africaine*.
- Nikolaus Hirsch is an architect, curator, editor, and educator. He is the director of CIVA in Brussels and was the Dean of Städelschule and Director of Portikus in Frankfurt. He is the author of the books *On Boundaries* (2007), *Institution Building* (2009), *Cybermohalla Hub* (2012), and co-editor of the *Critical Spatial Practice* series at Sternberg Press and co-founder of e-flux Architecture.
- Cymene Howe is Professor of Anthropology at Rice University. Her books include *Intimate Activism* (Duke University Press, 2013), *Ecologics: Wind and Power in the Anthropocene* (Duke University Press, 2019), *The Johns Hopkins Guide to Critical and Cultural Theory*, and *Anthropocene Unseen: A Lexicon* (Punctum, 2020). Her current research on cryohuman relations examines the dynamics between human populations and ice in the Arctic region and sea level adaptation in coastal cities around the world. She co-created the Okjökull monument in Iceland, the world's first memorial to a glacier felled by climate change, serving as a global call to action and in memory of a world rapidly melting away.
- Robin Kelsey is Dean of Arts and Humanities and Burden Professor of Photography in the Department of History of Art and Architecture at Harvard University. He holds a PhD from Harvard and a JD from Yale Law School. Professor Kelsey is the author of many articles and essays on the history of photography, as well as of the books *Photography and the Art of Chance* (Harvard University Press, 2015) and *Archive Style: Photographs and Illustrations for U.S. Surveys, 1850-1890* (University of California Press, 2007). He has received various awards for his scholarship and teaching, including the Arthur Kingsley Porter Prize.
- Bruno Latour is professor emeritus associated with the médialab and the program in political arts (SPEAP) of Sciences Po in Paris.
- Stephanie LeMenager is Barbara and Carlisle Moore Professor of English and Professor of Environmental Studies at the University of Oregon, where she co-directs the Center for Environmental Futures with Professor Marsha Weisiger.
- Nashin Mahtani is the director of Yayasan Peta Bencana (Disaster Map Foundation), where she leads a multidisciplinary team in developing software infrastructures for community-led disaster co-management. Co-leading one of the largest open source software projects for climate adaptation, her activism is dialectically driven by theory, scholarship and anthropology. With a background in architecture, Nashin's applied and research investigations center around water politics and infrastructures, communication and media philosophies, and epigenetic adaptations. She is also principal co-investigator of MERA, a research and design collective investigating the future articulation of governance structures foregrounded in ecological homeostasis. Nashin's work on social and ecological justice has been recognized widely, including most recently in Forbes 30 Under 30, 2021 list.

Kiel Moe is a practicing architect and the Gerald Sheff Chair in Architecture at McGill University. In recognition of his design and research endeavors, he was awarded a Fulbright Distinguished Chair in Helsinki; the Gorham P. Stevens Rome Prize in Architecture at the American Academy in Rome; the Architecture League of New York Prize; and the American Institute of Architects National Young Architect Award. He has published several books on architecture, including *Empire, State & Building*; *Wood Urbanism: From the Molecular to the Territorial*; *Insulating Modernism: Isolated and Non-Isolated Thermodynamics in Architecture*; and *Convergence: An Architectural Agenda for Energy*.

Karen Pinkus is Professor of Romance Studies and Comparative Literature at Cornell University. She is the author of *Fuel: A Speculative Dictionary* (University of Minnesota Press, 2016) and many works on the humanities and climate change as well as on literature, film and visual arts. She is the editor of *Diacritics*. Karen has collaborated with artist Hans Baumann on a number of projects and publications. Her current research is focused on thinking the subterranean and narrative as the temperature rises.

Hannah le Roux is an architect, educator and theorist. She is Associate Professor at University of the Witwatersrand, Johannesburg.

Anton Vidokle is the founder and director of e-flux.

Stephanie Wakefield researches human-environment relations, urban resilience, and social-ecological systems thinking. She holds a PhD in Human Geography from the Department of Earth and Environmental Science at the CUNY Graduate Center, and is Director and Assistant Professor of the Human Ecology program at Life University.

McKenzie Wark (she/her) teaches at The New School and is the author, most recently, of *Capital Is Dead* (Verso, 2019) and *Reverse Cowgirl* (Semiotext(e), 2020).

Kathryn Yusoff is Professor of Inhuman Geography in the School of Geography at Queen Mary, University of London. Most recently, she is author of *A Billion Black Anthropocenes or None* (University of Minnesota Press, 2018); "Geosocial Formations and the Anthropocene" (with Nigel Clark) in *Theory, Culture and Society*; "Epochal Aesthetics," "White Utopia/Black

Inferno," and "Mine as Paradigm" in e-flux and e-flux Architecture; and *Geologic Life: Inhuman Intimacies and the Geophysics of Race* (forthcoming).

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Nick Axel, Daniel A. Barber,
Nikolaus Hirsch, Anton Vidokle,
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Anton Vidokle

Copyediting:
Andreas Petrossiants

Design:
Noah Venezia

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